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# **Precautionary Expertise for GM Crops**

## **National Report – United Kingdom**

### **Precaution as Process**

Quality of Life and Management of Living Resources  
Key Action 111-13: socio-economic studies  
of life sciences  
Project n° QLRT-2001-00034

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## List of abbreviations

ACRE	Advisory Committee on Releases to the Environment
ACNFP	Advisory Committee on Novel Foods and Processes
ACP	Advisory Committee on Pesticides
abc	Agricultural Biotechnology Council
AEBC	Agriculture and Environment Biotechnology Commission
BSPB	British Society of Plant Breeders
DEFRA	Department of the Environment, Food and Rural Affairs
EC	European Commission
EU	European Union
EN	English Nature
FoE	Friends of the Earth
FSA	Food Standards Agency
FSEs	Farm Scale Evaluations
GMHT	Genetically-modified herbicide-tolerant
NAW	National Assembly for Wales
NFU	National Farmers' Union
RSPB	Royal Society for the Protection of Birds
SCIMAC	Supply Chain Initiative for Modified Agricultural Crops
SNCA	Statutory nature conservation agencies, e.g. English Nature

## Abstract

This report considers the recent 'precautionary approach' to commercialisation of GM crops adopted by the UK. Accounts of precaution and precautionary practices for GM crops in the UK are set against the backdrop of current debate concerning potential commercialisation of GM herbicide-tolerant crops. In October 1998 the Government announced its intention for a 'managed development' of GM crops. A major obstacle to commercialisation was the controversy over the possibility that broad-spectrum herbicides may be harmful to wildlife habitats. In response to these concerns Government funded a farm-scale research programme to consider the possible impacts on biodiversity of growing the GM herbicide-tolerant (GMHT) crops maize, sugar beet, and spring and autumn sown oilseed rape. These became known as the Farm Scale Evaluations (FSEs). At this time the Government also sought to widen its risk assessment procedures to include agro-ecological expertise. Industry agreed to postpone commercialisation until the FSEs provided the evidence required for a final decision on the commercialisation of the GM crops. However, as a precautionary measure, the Farm Scale Evaluations (FSEs) have been controversial. Rather than settling these environmental matters, as originally intended, they intensified debate by providing a focus for people's concerns.

Different interpretations of precaution are evident in the accounts UK policy actors give of the issues surrounding GM crops and commercialisation. Some policy actors are concerned that the precautionary principle could be used for ulterior motives; for example, industry groups are concerned about the potential for precaution to stifle innovation or to be used as a tactic for delaying commercialisation. Others view it as an opportunity for greater fairness, openness and inclusiveness. Precaution and the precautionary principle appear to be considered by people in the UK in at least two different ways: as a precise 'toolkit' i.e. a set of steps to follow, and as a mindset, i.e. as an underlying or implicit aspect of a person's perspective – that is, as something which is triggered in particular circumstances, and as something which is a more general way of acting.

Taking a precautionary approach has involved a general process of broadening expertise and inclusion of a wide range of views. A diversity of views is providing a valuable input into a negotiation over the path that society should take. The views are also highlighting uncertainties other than those dealt with by the scientific risk assessment process, such as uncertainties concerning biodiversity, co-existence of different types of agriculture, and the future of agriculture more generally.

The Government has been concerned over the lack of public confidence in decision-making processes. The establishment of the Agriculture and Environment Biotechnology Commission (AEBC) in 2000 aimed to build greater public confidence in the way Government dealt with issues other than the science. The AEBC's membership represents the broad spectrum of views on GM crops. Its members have sought ways for concerns to be more formally elicited, analysed and documented. The AEBC has been influential on Government thinking and action, particularly through its publications, which have raised the profile of criticisms of current risk regulation structures and have been a catalyst for deeper consideration of GM issues by all stakeholders. The AEBC has applied pressure on the Government for public policies and regulatory frameworks to expose and embrace the different views that exist on GM crops and to develop shared understandings. This pressure led Government to agree to hold a more formal, open, process of public debate alongside a review of the scientific issues of GM crops and a study of the costs and benefits of GM crops.

The formal public debate, called 'GM Nation?', represents an intentionally more formal approach to broadening expertise. 'GM Nation?' was an attempt to link expert judgements with broader public concerns for GM crops, and provided an opportunity for developing mutual learning. It was also an attempt to create an arena in which lay people could participate and therefore represented a step forward in the conduct of public consultation for policy decision-making processes in the UK. However, 'GM

Nation?' has done little to bring views closer together. It has also been criticised for the way that it was organised and financed. Throughout 'GM Nation?' it remained unclear how the 'public' views were to be fed into the overall decision. Further, there has been little advice provided to government as to how to deal with the wealth of perspectives, demands and expectations such processes generate.

Following the results of the formal public debate, and taking into consideration the results of the FSEs, the science review and the costs and benefits study, in January 2004 the Secretary of State for Environment, Food and Rural Affairs, Margaret Beckett, publicly stated the Government's intention to adopt a 'precautionary approach' to GM crops. Government announced that it would allow the commercial production of one GM crop, GMHT maize, until October 2006, subject to certain conditions. However, Bayer CropScience has since decided to discontinue its efforts to commercialise this GM forage maize in the UK.

The increasing likelihood of the commercialisation of GM crops in the UK has resulted in co-existence and liability becoming central to discussions. The issue of co-existence of GM and non-GM crops has highlighted not only the conflicting views of the organisations representing diverse farming communities within the UK, but also the tension between the national and local positions on GM crops.

Thus new approaches to the policy process are providing new opportunities for learning. There is greater communication between government advisory committees, and between those committees, NGOs and the wider public. Government structures are increasingly opening up, both intentionally and unintentionally, to wider expertise. As a result, Government has broadened its view of uncertainty as it has gradually accepted that decisions on commercialisation are more complex than it originally thought. Research agendas have broadened in response to queries from ACRE and the AEBC. Research is not simply providing 'evidence' for making policy decisions, but is contributing to a broader process of learning as policy actors rethink the policy problems. As research is used to endorse different opinions and further fuel debates it is contributing to a broader view of GM crops. Further, in highlighting the potential problems with GM crops, policy actors have raised the profile of wider issues, such as those associated with conventional agriculture or with the introduction of new technologies more generally. However, the opening up of government processes has yet to result in a calming of objections to the commercialisation of GM crops or criticisms surrounding scientific expertise. Yet events in the UK suggest that the period of the voluntary agreement with industry over commercialisation has been used constructively by the UK to further develop a 'precautionary approach', whose components and outcomes are being closely observed by other member states.

# Main findings

## Introduction

Although the precautionary principle has been widely accepted in Europe as a basis for decision making about GM crops, there are many perspectives on its interpretation and how it should be implemented. The PEG project has analysed how current European practices compare with different accounts of the precautionary principle. It has been examining different policy actors'<sup>1</sup> accounts of precaution and their views on the procedures for regulating and managing GM crops, in seven EU member states.<sup>2</sup> This report comments on the precautionary approach adopted in the UK.

Accounts of precaution and precautionary practices for GM crops in the UK are set against the backdrop of current debate concerning potential commercialisation of GM herbicide tolerant crops (see Annex I for a list of recent events). Biotechnology is viewed in the UK, by central government and proponents, as a way of increasing agricultural efficiency and attracting investment to create a more competitive industry. However, the statutory nature conservation agencies have expressed concern that the implementation of GM crops may be in conflict with measures that are designed to protect the environment.

In October 1998 the Government<sup>3</sup> announced its intention for a 'managed development' of GM crops. A major obstacle to commercialisation was controversy over the possibility that broad-spectrum herbicides might be harmful to wildlife habitats. Concern has been particularly acute as 69% of the land in the UK is registered as agricultural holdings and there are few remaining 'wild' areas. In response to these concerns, Government funded a farm scale research programme to consider the possible impacts on biodiversity of growing the GM herbicide-tolerant (GMHT) crops maize, sugar beet, and spring and autumn sown oilseed rape. This programme became known as the Farm Scale Evaluations (FSEs). At this time the Government also sought to widen its risk assessment procedures to include agro-ecological expertise. Industry agreed to postpone commercialisation until the FSEs provided the evidence required for a final decision on the commercialisation of the GM crops.

It was intended that the FSEs would settle matters regarding the effects of GM crops on biodiversity and enable commercialisation to go ahead. The Advisory Committee on Releases to the Environment (ACRE), a body whose membership included a range of views, had assessed the safety and health risks of the crops and concluded that they were safe. However, other concerns remained, for example, over the independence of risk research, the lack of inclusion of socio-economic issues or ethics in the assessment process, the effect on farm economics, the impact of agricultural intensification and the way that post-marketing monitoring measures would be implemented. In June 2000, in response to these other concerns and the lack of public confidence in GM issues, the Government established the Agriculture and Environment Biotechnology Commission (AEBC). The Commission's membership incorporated the range of views on GM crops. The members were charged with advising Government on the broader issues associated with biotechnology, including current and future developments in biotechnology in relation to agriculture and the environment, and with drawing in the public view.

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<sup>1</sup> In this research we take a broad view of the term 'policy actors' considering it to refer to all those engaged in contributing to the policy making process.

<sup>2</sup> The PEG project has research partners in Austria, Denmark, France, Germany, Spain, and the Netherlands. The project is co-ordinated by the UK team.

<sup>3</sup> The term 'Government' in this report generally refers to the UK National Government, which includes the devolved administrations of the Scottish Executive, the Welsh Assembly and the administration in Northern Ireland.

Following the EU adoption of the revised Deliberate Release Directive, 2001/18/EC, the revised directive was transposed into national law. In England the Genetically Modified Organisms (Deliberate Release) Regulations 2002 came into force on 17 October 2002. Similar regulations came into force for Scotland and Wales in December 2002, and for Northern Ireland in April 2003. The strengthening of environmental risk assessment under Directive 2001/18/EC has received support from all policy actors, although not without some criticism (see Section 3.1.2.2). Industry representatives, for example, expressed concern that the new directive might mean a tougher system that would impede development of the technology, leaving them at a competitive disadvantage. Environmental NGOs welcomed a more precautionary regime but felt it did not go far enough (DEFRA, 2002b). They felt that the amended directive still did not adequately address socio-economic and ethical issues, which, they argued, should be considered alongside the science-based issues.

Similar concerns about the regulation of GM crops were raised by the AEBC in their first published report, which was on the Farm Scale Evaluations (AEBC, 2001b). To address these concerns, one of the recommendations of this report was that the Government should initiate a formal national debate on GM crops. This recommendation was accepted by Government and a formal debate took place between 2002 and 2003. During the course of the formal debate (see Steering Board, 2003), many different perspectives on GM crops were gathered. In parallel, a review of the science (GM Science Review Panel, 2003, 2004), and a study of the costs and benefits (Strategy Unit, 2003) were also carried out. Research on people's views was additionally undertaken by the Food Standards Agency (FSA, 2002).

In autumn 2003 the results of the Farm Scale Evaluations were published (Burke, 2003) and the AEBC produced their second report, on co-existence and liability issues (AEBC, 2003). Having considered all this evidence, and following the advice from ACRE, on 9 March 2004 the Government outlined its 'precautionary approach' to GM crops. At the time, the Secretary of State for the Environment commented:

'I believe the approach I have outlined today is the right one. It is precautionary. It is evidence-based. In practice it means licensing one application, which runs till October 2006, and is subject to two further conditions' (DEFRA, 2004b).

Of the four crops tested in the FSEs, the Government gave a cautious go-ahead to the commercialisation of GMHT maize (which already had Part C marketing consent) and commented that it would oppose EU approval for the EU-wide commercial cultivation of GMHT beet and oilseed rape. Further, the commercial cultivation of the GMHT maize would only be allowed if restrictions were imposed on its EU marketing consent so that the maize could only be grown and managed as in the FSEs, or under conditions that would not result in adverse effects on the environment. The Government also commented on its intention to consider options for compensation to non-GM farmers for any financial loss, but imposed responsibility for such a scheme on industry, stating that 'any such compensation scheme would need to be funded by the GM sector itself, rather than by Government or producers of non-GM crops' (DEFRA (2004b) (see Section 3).

Throughout the process of gathering evidence for this decision policy actors raised concerns and sought to influence policy. The following sections discuss our findings concerning these influences and four aspects of precaution that emerged – precaution as requiring more research, as assessing risks and applying management measures, as a process of broadening expertise, and as a learning process. Our research drew on documents produced by all those concerned with GM issues and on the wealth of material generated by the formal public debate. Face-to-face interviews and telephone conversations were conducted with a range of representatives from Government, farmers' groups, environmental non-government organisations (NGOs), consumer organisations and industry (see Annex II). A scenario workshop with key policy actors was also used to inform the analyses (see Oreszczyn, 2003). Further details on methods may be found in Section 4. The next section comments on the 'precautionary approach' to GM crops in the UK.

## The precautionary principle and different approaches to precaution

Different interpretations of precaution are evident in the accounts policy actors give of the issues surrounding GM crops and commercialisation. While there are common elements to the views of Government, scientific experts, industry and environmental NGOs, differences surround the uses of the precautionary principle in practice (see Section 2). In the UK there has been no common view or consistent approach to the precautionary principle, even within government departments, as acknowledged by an interdepartmental report (ILGRA, 2002). Further, as noted by the Food Ethics Council (2003), the precautionary principle is only loosely defined in UK policy.

Different themes emerge as elements of people's thinking on precaution. Some people are concerned that the precautionary principle could be used for ulterior motives; for example, industry groups are concerned about the potential for precaution to stifle innovation or to be used as a tactic for delaying commercialisation. Others view it as an opportunity for greater fairness, openness and inclusiveness (see Table 1).

**Table 1 Emerging perspectives on precaution and GM crop**

<b>Emerging perspectives – key themes</b>	<b>Examples from documents and interview material</b>
<b>Precaution as proceeding with care</b>	Precaution is something people do anyway, that they exercise all the time. Industry does it already with new products.  Precaution is about 'proceed with great care' – the precautionary principle is exercised all the time in areas where there is incomplete knowledge.
<b>Precaution as good science</b>	It is a necessary part of good scientific practice.
<b>Precaution as a rational approach/framework for decision making</b>	Implementing the precautionary principle should not be based on emotions.  Some stakeholders are particularly keen that a greater following for the EC's communication on the precautionary principle will lead to a more rational approach to decision making.  Arguments against irrational precaution refer to the way no harm has happened yet – no detrimental health effects, no contamination of organic agriculture during field trials.
<b>Precaution as a means for greater openness</b>	Transparency is particularly important for NGOs and farmer groups. For example, calls for results of any monitoring programme to be in the public domain.  The AEBC is a good example of attempts at openness in Government advisory committees.
<b>Precaution as a mechanism for placing policy decisions within a societal context</b>	We should question the need for the technology in the first place.  It should also mean the inclusion of an evaluation of all possible options.  Precaution should involve widening decisions beyond a narrow scientific base.
<b>Precaution as a pretext</b>	The public debate will be indecisive, Government will use it to back their decision either way.
<b>Precaution as inclusive</b>	Precaution means including more views.

	The public debate is viewed as playing an important role in opening up the debate.
<b>Precaution as fair</b>	The costs and benefits of GM crops are not necessarily evenly distributed. NGOs call for consideration of this in the assessment process.
<b>Precaution as a means for stifling innovation</b>	Concern that the precautionary principle will be used to prevent technological developments. Commercialisation of GM crops will go ahead, it is just a question of time. The precautionary principle should not be invoked to slow development down.
<b>Precaution as a delaying tactic</b>	Precaution is viewed as slowing things down, to delay the decision-making process for as long as possible. Given time the public will change their views and this will be reflected in Government decisions.
<b>Precaution as an iterative and flexible process</b>	Moving with the situations as they change, as the technology develops. Precautionary measures need to be flexible, they need to be appropriate to the different products and contexts.
<b>Precaution as a reputation enhancer/as demonstrating responsibility</b>	Business may utilise precaution to demonstrate their ability to be responsible. There is a growing realisation that it is an essential element in the corporate environment. Growing concern over the way that NGOs/media conduct themselves in GM debates – calls for greater responsibility.
<b>Precaution as a long term view</b>	Provides an opportunity to consider the future – should be a long term rather than a short term view.
<b>Precaution as irrelevant</b>	No commercialisation of GM crops would mean there is no need for precaution.

The variety of themes highlighted in Table 1 relates to the different views on precaution held by different policy actors. Industry has developed its own precautionary approaches, either in the form of set guidelines or codes of conduct. Biotechnology companies take the view that if adequate risk assessment and management procedures are in place then there is no need for further action based on the precautionary principle. They consider that caution is employed at all stages of product development automatically as they would not wish to bring to market a product that was unacceptable to their customers and therefore had no market. They have little sympathy for the organic farming lobby who oppose the introduction of GM crops, accusing them of adopting an ideological position for their own commercial gain. They feel uncomfortable about further public engagement in processes where public concerns may be based on emotion rather than sound science. Industry remain convinced that GM crops are safe to human health and the environment and that management practices can be employed to ensure that non-GM farmers are protected. Measures such as the FSEs are seen as demonstrating precaution through greater scrutiny of the science. They therefore see no real justification for employing further precautionary measures, which they say would prevent GM crop commercialisation.

For environmental NGOs, the precautionary principle is viewed more as a framework for being precautionary than as a set of rules for triggering the precautionary principle, which is the way the principle is seen in the EC's Communication (EC, 2000). NGOs believe the precautionary principle should encompass a careful weighing up of all the costs and benefits of GM crops and consideration of who benefits and why, rather than simply an assessment of the health and environmental risks. For NGOs, a precautionary approach would mean taking a number of actions.

For example, it would mean the regulatory process taking the assessment of risk acceptability as seriously as the evaluation of the level of risk; withdrawing marketing consents for all GM foods until there has been a review of their safety; ending the use of substantial equivalence for testing GM food safety; introducing a monitoring scheme that allows the assessment of the short and long-term effects of eating GM foods; weighing up alternatives among GM and non-GM options; and assessing secondary effects, such as herbicide residues in GM plants. Whereas industry puts faith in the Government to apply the precautionary principle in the regulatory process, environmental NGOs are critical of the Government's 'expert'-led, top-down approaches to risk regulation and the lack of recognition of broader societal concerns. Experts are viewed as being insulated from the risks, and communication is seen as often being one-way.

With respect to the EC Communication on the precautionary principle (EC, 2000), interviewees were aware of the document, which they considered to be useful or a step in the right direction, but they had not necessarily referred to it recently or did not necessarily know its content in detail. Government and some organisations, such as the Consumer's Association (see Consumer's Association, 2002), the Crop Protection Association, and English Nature have been developing their own interpretations of the precautionary principle, some based on the EC Communication, translating the principle into practical guidelines for dealing with uncertainties in their own particular field. In its report *Crops on Trial* (AEBC, 2001b), the AEBC comments that a precautionary approach should be holistic, protecting those affected by an activity rather than those who benefit, acknowledging the complexity of the real world and recognising the vulnerability of the natural environment. Other organisations do not necessarily articulate their views on the precautionary principle, rather, it appears to be an underlying feature of their perspectives. They rarely use the word uncertainty in the narrow way it is used in the EC Communication, which refers primarily to scientific uncertainty, and consider precaution to be more a general way of acting.

Precaution and the precautionary principle therefore appear to be considered by people in at least two different ways: as a precise 'toolkit', i.e. a set of steps to follow, and as a mindset, i.e. as an underlying or implicit aspect of a person's perspective. This difference has also been noted by Willis and Oldham (2002), who considered the precautionary principle in general, rather than specifically in relation to GM crops. A tension therefore exists between the need for more formal approaches to precaution with a clear procedure based on science and scientific expertise, as set out in the EC Communication (EC, 2000), and a more open process – that is, between something which is triggered in particular circumstances, and something which is a more general way of acting. Formal approaches are favoured at the European policy level and by industry. However, for GM crops in the UK, precaution in practice has tended to operate using an informal, process-based interpretation of the precautionary principle. Taking a precautionary approach, on the part of different actors, has involved a wide range of views, providing a valuable input into a negotiation over the path that society should take. These views (about precaution generally and GM crops in particular) have highlighted uncertainties other than those dealt with by the scientific risk assessment process, such as uncertainties concerning biodiversity, co-existence of different types of agriculture, and the future of agriculture more generally. A formal commitment by Government to adopt a 'precautionary approach' came with the announcement of its decision on GM crops, discussed below.

## **The Government decision on the commercialisation of GM crops in the UK**

In January 2004 the Secretary of State for Environment, Food and Rural Affairs, Margaret Beckett, announced the Government's decision to license one GM crop application, GMHT maize, until October 2006, subject to certain conditions. At the same time, she publicly stated the Government's intention to adopt a 'precautionary approach' to GM crops, commenting 'I believe the approach outlined is the right one. It is precautionary.' (DEFRA, 2004c).

The decision to allow the commercialisation of GMHT maize was unpopular with many policy actors. While industry representatives welcomed the Government's decision as a step forward, they remained concerned that the decision was 'very cautious' (CropGen, 2004). In the industry view, precaution could mean 'stifling innovation' or a 'delaying tactic', as noted in Table 1. The National Farmers' Union (NFU) also gave their cautious approval, but remained concerned over who would be liable should anything go wrong, i.e. 'precaution as fair'. Organic farmers and the devolved administrations commented on the unresolved issues concerning co-existence. Environmental NGOs pointed out that the risks outweigh the benefits and accused the Government of failing to listen to the views of consumers (referring to the public's negative views outlined in the report on the formal public debate), i.e. 'precaution as inclusive' in Table 1. At the time, the director of Friends of the Earth commented:

'The Government has given the thumbs up to GM maize, and shown two fingers to the British public. In demonstrating its pro-GM credentials, the Government has ignored considerable scientific uncertainties, shown contempt for parliament and utterly disregarded public opinion.' (FoE, 2004).

Bayer CropScience subsequently announced that it would 'discontinue further efforts to commercialise GM forage maize in the UK' as they now considered it would be uneconomic (Bayer press release, 31 March 2003). The constraints Government had placed on the approval provoked Bayer to comment:

'The specific details (of the conditions) are still not available and thus will result in yet another 'open-ended' period of delay. These uncertainties and undefined timelines will make this five-year old variety economically non-viable.' (Bayer press release, 31 March 2003).

This decision was viewed as something of a victory by those sceptical of GM crops.

### **An evidence-based decision**

In line with a wider move towards more evidence-based approaches to policy decisions in the UK, the Government has been keen to ground any decision on GM crops firmly on evidence. Building the evidence-base has involved not simply focusing on scientific research but also on socio-economic research and the views of the wider public. This has been key to enabling the Government to meet its obligations under the European Deliberate Release Directive while at the same time acknowledging that stakeholder concerns go beyond those dealt with by the usual scientific risk assessment process. Constructing a wider evidence base provided grounding for the Government's 'precautionary approach'. It also served as a constructive use of the period of the voluntary moratorium on GM crops.

However, building the evidence base has tended to mean building the *scientific* evidence base. Responding to the formal debate process, Margaret Beckett stated that the Government had carefully listened to people's views and considered all the evidence:

'In deciding our policy on GM crops we have given due consideration to the findings of all three strands of the GM dialogue'.

However, she added that:

'We have concluded that case-by-case regulation of GM crops remains the right approach. We are committed to evidence-based policy making and the scientific evidence supports neither an outright ban nor a blanket acceptance of GM crops.' (DEFRA, 2004a).

While the Government acknowledged that there were gaps in the knowledge base, they commented that this is true of any developing technology. The Government accepted the conclusions of the economics study that GM crops may be of limited economic value in the UK at present. However, they concluded that future developments have the potential to provide 'wide ranging benefits to farmers and

consumers'. The following section considers the construction of the evidence base for the Government's decision.

## **Regulatory measures: precaution as building the evidence base**

This section considers the key evidence used by the Government for making its decision on the commercialisation of GM crops. Although the focus was on gathering scientific evidence, the economic impacts of GM crops were also investigated, along with an investigation of the wider public views in a formal process of public debate. The Farm Scale Evaluations played a significant role in the Government's 'precautionary approach' and are discussed first. Details of other recent scientific research in the UK may be found in Annex III.

### **The Farm Scale Evaluations**

The Farm Scale Evaluations (FSEs) research programme began in 1999 (DEFRA, 2002b) following concerns over the impacts of GMHT crops on the environment. The evaluations were funded by Government and run by a consortium of independent researchers. They investigated how growing genetically modified crops might affect the abundance and diversity of farmland wildlife as compared with conventional crops. The crops involved were herbicide-tolerant winter and spring oilseed rape, maize and sugar beet. The evaluations lasted for four years and represented the world's largest GM crop field trials (Burke, 2003). As noted by English Nature (House of Commons, 2004), this was the first time that a major new technology had been examined for its impact on a farming system (see Section 3.1.1.1).

The results of the spring oil seed rape, maize and beet trials were published in 2003 (The Royal Society, 2003). The results for winter sown oilseed rape, the crop most commonly grown in the UK, were expected later, in 2004 (House of Commons, 2004). Fewer weeds were observed in the fields planted with GMHT beet and oilseed rape than those planted with conventional crops. For maize, more weeds were found in the fields planted with GMHT maize. The researchers therefore concluded that growing GMHT beet and spring rape on a large-scale might exacerbate the long-term decline of arable weeds and disadvantage wildlife, while growing GMHT maize might benefit farmland birds (The Royal Society, 2003). In commenting on the results, both scientists and industry were keen to emphasise the importance of farm management practices in determining the impact of growing GM crops on wildlife and the environment. They further pointed out that the trials were never intended as a test of GM crops themselves but of the way GM crops may be used. In their statement on the results, the industry body the Agricultural Biotechnology Council (abc) commented that:

'genetic modification is a tool which can be used in different ways with different management practices resulting in different outcomes', adding that 'none of the studies published this year support the banning of any GM crops.' (abc web site, March 2004).

As anticipated by the UK scenario workshop held with key policy actors in mid-2003 as part of this project (see Oreszczyn, 2003), the FSEs led to further arguments over the interpretation of the results and their value for making a decision on commercialisation, particularly as the decision was made before all the results were published. Critics were concerned that the FSEs provided only limited data and not a definitive risk assessment. For example, critics' submissions to ACRE expressed concerns about the lack of reporting of crop yields, the use of herbicides in conjunction with GM crops in a real farming situation, the exclusion of wider environmental and health effects, the lack of a comparison with organic farming, and the lack of monitoring of relevant species, such as earthworms (ACRE, 2004). The use of conventional agriculture as a bench mark for the comparison with GM agriculture, rather than less-intensive and more environmentally-friendly methods, was particularly criticised. In December 2003, an all-party parliamentary committee

inquiry was carried out into the value and relevance of the FSEs and to consider some of these concerns (House of Commons, 2004). This committee, like other groups and individuals such as Friends of the Earth and the former Environment Minister Michael Meacher, questioned the validity of the FSE results because they involved the use of atrazine, a chemical being phased out in the EU. The parliamentary committee recommended that commercial planting should not occur until the crop had been re-trialled without the use of atrazine. Commenting on the FSE results, they also noted that 'there is still a certain unwelcome inconclusiveness to what is an unfinished process' (House of Commons, 2004). In making its decision to commercialise GMHT maize, the Government has gone against the recommendations of this committee. However, Government recognised that the FSEs provide only part of the environmental impact assessment, and admitted that the FSEs may not reflect the effects of general commercialisation.

Despite the criticisms, the FSEs heralded a new style of more open research practice in the UK. Their high profile led to a demand for every aspect to be subject to scrutiny and for details such as the location of the trials to be publicly available. They were proclaimed as an example of 'best science' (Solesbury, 2003), in that the research was well resourced, with careful attention given to every aspect.

### **The science review**

The Government has acknowledged that there are differing interpretations of the scientific evidence base for GM crops. A more thorough examination of the scientific research, and of the divergent views among scientists, was recognised as a necessary part of the public consultation exercise. In August 2002 the Government set in motion a Science Review to complement the formal public debate (see Section 3.1.1.2). As part of its remit, the Science Review Panel gave special attention to uncertainties, unknowns and gaps in knowledge. It did not aim to conduct an exhaustive survey of all that is known. Instead, people's concerns were allowed to drive the review, which examined the evidence for harm and also the evidence for absence of harm. The Panel was chaired by the Government's chief scientist and the evidence was assessed by a broad range of non-specialists, social scientists and scientists. The panel concluded that there were no known health effects from GM foods, but that 'absolute safety does not exist'. It advocated that regulation should proceed on a case-by-case basis, as it does at present. It recommended further research on food allergies, potential changes in soil ecology and farmland biodiversity, and the consequences of gene flow (GM Science Review Panel, 2003).

All sides of the GM debate considered the report to substantiate their particular perspective and in their responses drew on aspects of the report that supported their views. For example, the anti-GM lobby commented that the report recognised the limitations of the technology and testing regime and reiterated their concerns about the experimental nature of such a new technology. The wildlife conservation body, English Nature, was encouraged by the way it highlighted the potential effect on farmland wildlife as a key issue. Industry welcomed the support of the requirement for a case-by-case approach to regulation and felt that the report endorsed their view that there are no observed effects on health.

### **The economics study**

In parallel with the Science Review, the Government also initiated an economics study to consider the costs and benefits of GM crops. This was carried out by the Prime Minister's Strategy Unit (Strategy Unit, 2003). Like the Science Review the study considered the views of the wider public as well as experts and was carried out by a multidisciplinary team. It commented on the economic impacts of GM crops in other countries as well as the UK. The analysis did not adopt a conventional cost-benefit approach; rather, it considered how the impact of GM crops would be felt across five different potential future scenarios. It concluded that: a future either with or without GM crops will entail trade-offs between costs in one area and benefits in another; any economic benefit of GM crops is likely to be limited in the short-term; public and consumer attitudes are of central importance; there is significant potential

for benefits from future developments, but current GM crops do not offer significant benefits, particularly for consumers; and that international implications could be significant to UK and EU decisions.

As with the Science Review, the responses to the economic study from all sides of the debate emphasised the aspects of the costs and benefits report they felt supported their particular viewpoint. For environmental NGOs, the report was perceived as a step towards the Government ending its commitment to GM crops and confirmed their view that there is little economic justification for commercialisation of GM crops. Conversely, the Agricultural Biotechnology Council (the abc), an industry alliance, stated that they fully agreed with the report that existing commercial GM crops would offer 'cost and convenience advantages to UK farmers when introduced commercially' (abc web site, March 2004).

### **Research as part of the learning process**

A general tension exists in the UK between the Government's desire to encourage the development of new technologies for economic and social benefits and their desire to maintain consumer choice and public trust. As also noted by Levitt (2003), such tensions have led to an evidence-based approach to policy whereby decisions can be seen to be based on sound evidence. As noted earlier, in the case of GM crops this has generally meant scientific evidence. All policy actors view research as a necessary part of precaution. However, for those critical of the introduction of GM crops, the evidence provided by the scientific studies remains inadequate. There is concern among those outside industry, for example, among organisations such as the Five Year Freeze and Genewatch, that not only is there not enough research being done, but that there should be more diversity of expertise involved in the research and its interpretation. There is concern about the independence and hence the trustworthiness of the conclusions, leading some policy actors to insist that more independent, public sector, GM crop research is carried out. Research on alternative approaches to GM is also considered to be seriously under-funded. Disagreement with industry and government scientists over the evidence for the successful use of GM crops has led some policy actors to commission their own research, for example the Soil Association has drawn on the experiences of North American farmers (Soil Association, 2002). However, the way research is used by different policy actors within debates is not straightforward. For example, the same research is often being used to support opposing arguments (see Section 3.1.1.4).

As the Government commissions more research, areas for further research are highlighted. For example, the Farms Scale Evaluations not only provided information on growing HTGM crops but also highlighted broader issues concerning agriculture and the environment. Government initiatives to involve the wider community through the formal public debate have also highlighted key areas for research, such as the balance between public and privately funded research and the need for consideration of the wider role of agriculture<sup>4</sup>. Recently the Environmental Audit Committee noted that 'the government and its advisory bodies are still guilty of setting too low the level of harm' (House of Commons, 2004). NGOs, consumer groups and the organic farming lobby are also challenging the Government's view of harm. Future scientific and socio-economic research, informed by the results of the FSEs, the Science Review and the economics study, has the potential to enable investigations that contribute to a wider view of environmental impacts and a broader view of 'harm'.

Research is therefore part of a policy learning process. It is not simply providing 'evidence' but is contributing to a process of learning as policy actors rethink the policy problems. Since the establishment of the FSEs, the AEBC, in particular, has been instrumental in highlighting gaps in knowledge and failings in research policies, which have led to a shift in the Government's position. Although there are criticisms, research agendas have broadened in response to queries from ACRE and the AEBC,

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<sup>4</sup> The AEBC is to consider the gaps and inconsistencies between research and policy agendas in its future work (AEBC, 2004).

and in response to questioning from critics. The Government has broadened its view of uncertainty as it has gradually accepted that decisions on commercialisation are more complex than it originally thought. Thus research is being used to endorse different opinions and further fuel debates and as a result, it is contributing to a broader view of GM crops.

## **Regulatory measures: precaution as assessing and managing risks**

The UK Government has stated that it has no fundamental objections to the introduction of GM crops provided it meets current regulatory requirements. As noted earlier, the Government claims that it is adopting a 'precautionary approach' to the introduction of GM crops, commenting that the regulatory regime is 'firmly based on the precautionary principle as applied on a strictly case-by case basis' (DEFRA, 2004a). This desire to maintain a case-by-case approach, where each application is judged on its own merits, is supported by industry. However, the process of assessment is not perceived by policy actors as a static, one-off process. As noted by the Science Review Panel:

'Regulatory evaluation needs to keep pace with the challenges posed by developments in this technology and recognise progress in understanding and knowledge.' (GM Science Review Panel, 2003).

A key criticism of the current regulatory process is that the focus on the risk to health and environment takes no account of the broader concerns of many policy actors and members of the public. Those critical of GM crops remain sceptical about the capacity of the regulatory regime to control the technology. Such scepticism is reinforced by incidents such as that in 2002 when GM rape seed containing antibiotic material was found in the FSE sites. There remains a lack of trust in the scientific judgements being made, and 'expert' perceptions are viewed as not being grounded in the real world. Further, critics of GM crops point out that risk assessment and management do not take account of the fact that the costs and benefits are not the same for everyone.

The point at which precaution is brought into the assessment of a new product is also disputed. As noted earlier, industry views precaution as already operating at an early stage in the regulatory process, whereas other policy actors consider that it is brought into the process too late, for example at the stage of deciding what products to develop. Further, the FSEs have highlighted the need for a broader assessment, to consider issues surrounding co-existence of different types of agriculture. It has also highlighted the need to consider the impacts associated with conventional agriculture, particularly to satisfy the needs of those seeking improvements in comparisons between GM and non-GM agriculture.

## **Broader assessment: precaution and co-existence**

The increasing likelihood of the commercialisation of GM crops in the UK has resulted in co-existence and liability becoming central to discussions. The issue of co-existence of GM and non-GM crops has highlighted not only the conflicting views of the organisations representing diverse farming communities within the UK, but also the tension between the national position on GM crops and local positions (see Section 3.3.1.2). Each devolved administration in the UK – England, Scotland, Wales and Northern Ireland – has its own competent authority. Therefore, following the co-existence amendment to EC Directive 2001/18/EC, each region may introduce its own co-existence arrangements. The devolved administrations of Wales and Scotland, where not all ministers agree with the national decision on GM crops, have been particularly vocal about their concerns. The Scottish Government for example, has stated 'We will rigorously apply the precautionary principle in our approach to GM crops' (AEBC, 2003). A number of counties within England, such as Devon and Dorset, are promoting themselves as GM-free areas. An example of the strength of feeling comes from Yorkshire Council, where one councillor is attempting to make

things difficult for the Government by encouraging people to grow organic maize in their gardens and allotments with the aim of forcing the Government to consult with each individual (BBC Radio 4, 2004). The National Assembly for Wales (NAW) has set its own policy regarding GM crops. It is applying the most restrictive approach possible within EU legislation, with the aim of keeping its products distinctive for marketing purposes. Although this is a commercial position, environmental arguments are used for taking precautionary measures. The Welsh Assembly, in particular, is perceived as being instrumental in raising the profile of co-existence issues at EU level and putting the issue of the co-existence of GM and non-GM crops firmly on the EU agenda (see Section 3.1.3.3).

In 2003 the AEBC issued a report on co-existence and liability issues (AEBC, 2003). Their report focused on the need to maintain consumer choice. The AEBC listed nine recommendations (see Section 3.1.3.1) and concluded that if commercialisation goes ahead, greater caution should occur in the initial years. While the FSEs highlighted concerns over the co-existence of GM and non-GM agriculture, advocates of commercialisation are quick to point out there has been no loss of organic status throughout the period of the FSEs. They argue that as co-existence is a farm management issue and not an issue related to the genetic modification itself, solutions to any difficulties can be found. Thus the FSEs and issues concerning co-existence have highlighted the importance of farm management practices for GM crops.

A key problem noted in the AEBC report (2003) is that of compliance with any co-existence protocols where there is no market driver to ensure that a farmer growing GM crops will protect their neighbour (see Section 3.1.3.4). Industry cites previous experience with a poisonous crop, high erucic acid oilseed rape<sup>5</sup>, as demonstrating that protocols can be made to work. While industry have a preference for a voluntary code of practice, the AEBC, whose members cover the range of views on GM crops, generally concluded that statutory backing for the key elements of a co-existence regime was advisable and was more likely to gain the confidence of the various stakeholders.

It is currently Government policy to increase the market share of organic crops, particularly within the regionally-devolved administrations. Increasing organic production will place increasing pressure on GM farmers to ensure that organic fields remain organic. The most appropriate threshold levels for unavoidable (adventitious) presence of GM material in non-GM crops or produce is therefore the subject of much controversy (see Section 3.2.2). The leading certification body for UK organic production, the Soil Association, have set their own *de facto* 'zero' threshold of 0.1%<sup>6</sup>, i.e. far below the 0.9% required by EU law (AEBC, 2003). Industry considers a threshold of 0.1% to be unreasonable and argues that successful co-existence under such a low threshold is probably unachievable. While the organic lobby consider a low threshold to be essential to meet the demands of its customers, low thresholds are perceived by industry as an obstacle deliberately placed in the way of the commercialisation of GM crops by the organic lobby.

There are many unresolved aspects associated with maintaining an effective co-existence protocol. Questions remain about what farm assurance and stewardship scheme should be implemented, how to provide an appropriate land information system, who should pay for auditing and monitoring, and who should compensate non-GM growers for any resulting economic loss. As the UK has not yet experienced growing GM crops on a commercial scale, the likely extent of any problems remains unclear. Yet debates concerning co-existence have highlighted potential difficulties and unknown consequences not only as a result of planting GM crops, but also with modern-day agriculture more generally.

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<sup>5</sup> For growing high erucic acid oil seed rape (HEAR), maintaining separation distances is essential as it must not enter the food chain. Industry protocols for this crop already exist (AEBC, 2003).

<sup>6</sup> 0.1% is the limit of technical measurability.

## **Expert judgements: precaution as broadening expertise and seeking legitimate decisions**

Precaution in the UK has involved a general process of broadening expertise, with the Government seeking to be seen to be open and therefore to be making more legitimate decisions. Experiments in governance, such as the establishment of the AEBC, are leading to increasing openness in expert judgements, and greater input into the process by a wider range of stakeholders. The broadening of expertise and the inclusion of a diversity of views on precaution and GM crops is an on-going process. The expertise changes as the membership of bodies (such as the Advisory Committee on Releases to the Environment (ACRE) and the AEBC) change, as their sub-groups focus on new issues, as they draft in or take evidence from additional experts, and as they interact with one another.

The UK Government is keen to rebuild public confidence in science through public debate. For example, in a speech on science and innovation in 2002 the Prime Minister announced that:

‘We need, (therefore), a robust, engaging dialogue with the public. We need to re-establish trust and confidence in the way that science can demonstrate new opportunities, and offer new solutions.’ (Prime Minister’s Speeches 2002).

Yet, as noted previously, many of the concerns of those worried about, or opposed to, GM crops are not just about the science and safety issues, but about processes such as the independence of risk research, the exclusion of socio-economic issues and ethics from assessment processes, the threat to farming as a commercial operation, the impact of agricultural intensification on biodiversity, and the way that monitoring will be carried out. The establishment of the AEBC in 2000 aimed to build greater public confidence in the way government dealt with these issues. The AEBC has sought ways for such concerns to be more formally elicited, analysed and documented.

Although lacking the statutory authority of ACRE, as a strategic advisory body the AEBC has been influential in people’s thinking on issues relating to GM crops. It has raised the profile of criticisms of current risk regulation structures and its reports have been a catalyst for deeper consideration of GM issues by all stakeholders. Operating in a more open way than ACRE, the AEBC has been critical of the lack of transparency over how experts make complex social and political judgements. It has provided a means for focusing and highlighting current concerns over GM crops and a means of legitimising factors other than the science. Further, it has enabled the inadequacies of regulation and government communication to be revealed. Of particular concern for its members, despite the difficulties involved, has been ways to involve all stakeholders’ views and ways of engaging with the public. The broad spectrum of views represented by AEBC members has not necessarily resulted in a consensus on issues, but nevertheless has resulted in reports welcomed by most stakeholders. It has been influential on Government thinking and action, particularly through its publications. The AEBC has applied pressure on the Government for public policies and regulatory frameworks to expose and embrace the different views that exist on GM crops and to develop shared understandings (see AEBC, 2001b). This pressure led Government to agree to hold a more formal, open, process of public debate alongside the science review and the economics study of GM crops.

### **‘GM Nation?’ – the formal public debate**

The formal public debate represented a way for Government to meet its aim of restoring people’s confidence in science. Anyone was invited to contribute to the consultation process through the web site and later through open meetings (see Section 3.2.3). The Government commented at the time that ‘The intention is to create a dialogue between all strands of opinion on GM issues’ (Government response to AEBC, April 2002), indicating its desire to restore people’s confidence in processes.

'GM Nation?', the official 'public debate', has been recognised by many stakeholders as an innovative endeavour (see for example, Stebbings, 2003). It was an attempt to link expert judgements with broader public concerns for GM crops, and provided an opportunity for developing mutual learning. While not without criticism (see Section 3.2.3) and with varying degrees of success, it was also an attempt to create an arena in which lay people could participate. The Steering Board made deliberate attempts to frame the debate around the real concerns of members of the public and in terms that they would understand, rather than those of the 'experts'. Serious efforts were made to provide people with the necessary background material to enable their participation and to go beyond consulting those who would normally make contributions. This represents a step forward in the conduct of public consultation for policy decision making processes in the UK.

However, 'GM Nation?' has done little to bring views closer together. It has also been criticised for the way that it was organised and financed. The Select Committee for the Environment, Food and Rural Affairs, which conducted an inquiry into the conduct of the debate, although complementary of many aspects, upheld the industry view that the main element of the debate was biased, commenting that:

'The debate also did not engage people beyond a self-selecting group which already held views about GM. Thus the wider public was in the main not informed by the debate, and nor were their opinions canvassed.'  
(House of Commons, 2003).

Further, structuring the overall debate in such a way that the Science Review was considered entirely separately from the public part of the debate has done little to bring non-scientific and scientific concerns together. Throughout 'GM Nation?' it remained unclear how the 'public' views were to be fed into the overall decision about commercialisation, leading to further distrust at a time when the Government is keen to rebuild trust. Yet 'GM Nation?' represents an intentionally more formal approach to broadening expertise.

Thus Government structures are increasingly opening up, both intentionally and unintentionally, to wider expertise. As a result of establishing the AEBC and widening ACRE's scientific expertise, the Government has responded to concerns as they arise. However, while the Government is attempting to broaden expertise beyond official bodies, stakeholders remain critical of the way that expertise is still limited and of the quality of expertise for looking at uncertainties. For example, the public consultation procedures within the UK's interpretation of the new Deliberate Release Directive have been criticised as inadequate, and the adequacy of the scientific evidence and the scientific abilities of ACRE are being questioned, particularly over approval for T25 maize (see Section 3.2.1.1). Further, although Government has attempted to respond to calls for wider and improved communication and consultation processes, there has been little advice as to how to deal with the wealth of perspectives, demands and expectations such processes generate.

## **Stakeholder roles: precaution as learning and reflecting**

As noted earlier, at the extreme ends of the spectrum of views on GM crops, the different perspectives of the policy actors remain highly polarised. At each stage of the decision making process concerning the commercialisation of GM crops in the UK, the various policy actors have presented versions of the issues, for example, through web sites, the media, or at meetings, workshops and public events. They have formed alliances to strengthen their positions in the debate and to challenge other perspectives. For example, industry established a platform for the views of those with positive experiences of GM crops, called the Agriculture and Biotechnology Council (abc), which brings together BASF, Bayer Crop Science, Dow Agrosiences UK, Dupont, Monsanto UK and Syngenta (see Section 3.3.2). Industry is anxious for Government to convey a positive message about GM crops and not to allow precaution to be used as a delaying tactic or a means for stifling innovation, as noted earlier. Opponents of GMOs have also formed alliances, such as the Five Year Freeze Campaign, an alliance of 120 organisations including local authorities and

businesses, initiated in 1999 in response to the first GMO imports (see Section 3.3). Through the Soil Association, the organic lobby have been particularly vocal in their resistance to GM crops. Bodies such as the AEBC play an important role in attempting to reconcile these opposing views.

Thus the 'precautionary approach' taken by the UK is not only a dynamic process but also a learning process for those involved. Government is learning that the process is more important than the science itself, as few people are sufficiently knowledgeable to be critical of the detail of the science. Clarity, openness and inclusion are considered important characteristics of decision making and are consequently aspects which attract criticism and affect trust. The wider range of expertise on official bodies is adding legitimacy to official reports and enabling more inclusive and hence less contested analysis of situations.

The formal public debate, in particular, provided an opportunity to engage policy actors in a process of reflection. The Government, for example has reflected on the lessons it may learn from the public debate (see DEFRA, 2004c). Industry and environmental NGOs have continuously been considering their position in the light of others. The public has been given an opportunity to comment and reflect on issues in a way that goes beyond what has been done before. Web sites, in particular, have become an important vehicle for reflection and the promotion of different perspectives and differences of opinion. They have offered a means for highlighting new or specific issues. The richness of views is contributing to a negotiation over what kind of future society would like to see. Further, in highlighting the potential problems with GM crops, policy actors have also raised the profile of wider issues, such as those associated with conventional agriculture or with the introduction of new technologies more generally.

Communication is therefore an important ongoing process for a precautionary approach. As noted earlier, industry is forming alliances and so are NGOs. There is greater communication between government advisory committees and between those committees, NGOs and the wider public. There is increasing realisation of the need to work together to find mutually acceptable outcomes. However, the difficulties encountered by the AEBC in its report on co-existence, particularly with obtaining agreement among its members on reasonable thresholds and appropriate measures for co-existence, demonstrate the limits to achieving agreement by means of greater stakeholder involvement (see Section 3.2.2). Further, the form of communication is itself a controversial issue among policy actors. For example, the National Consumer Council (2002) comments that 'traditional risk communication typically sees the process as an add-on at the end of the risk management process', exemplified by 'we make the decision and then we tell you what the decision is'. They remain critical of 'one way dialogue' and communication in the form of information provision.

The deliberate policy to broaden expertise in risk regulation has set in motion a process of inclusion of expertise beyond government expectations. It is a process that may undermine rather than help to achieve the stated Government aim of restoring public confidence in science as the basis for policy making. The inclusion of many perspectives means that evidence and processes become more open to diverse interpretations. The response to these interpretations is critical for building trust. For many stakeholders, the decision-making process means being open to different outcomes and reaching decisions which encompass more perspectives. It therefore means going beyond the traditional 'expert'-led models to the introduction of technology. Further, if the Government is to succeed in its aim to rebuild trust, a wider range of concerns than those dealt with by the current regulation process would need to be adequately addressed.

New approaches to the policy process are providing new opportunities for learning. However, the opening up of government processes has yet to result in calming objections to the commercialisation of GM crops or criticisms surrounding scientific expertise. Further, Government experiments with new national structures do not necessarily mean it is adequately addressing local concerns. The promotion of more open processes within national government and inclusion of wider expertise and hence broader concerns is highlighting the way that the UK is restricted by the

requirements of EU directives. The ability of the UK Government to respond to wider needs is constrained by the emphasis placed on science-based regulation at the European level. Nonetheless, events in the UK are contributing to a wider learning process at this level. For example, data from the Farm Scale Evaluations on biodiversity and reports from the public debate are providing information that may be relevant to other countries in Europe. The period following the voluntary agreement with industry over commercialisation has therefore been used constructively by the UK to further develop a 'precautionary approach' that is closely observed by other member states.

# 1 Introduction

Accounts of precaution and precautionary practices for GM crops in the UK are set against the backdrop of current debate concerning potential commercialisation of GM herbicide tolerant crops. Commercialisation of GM crops is further set within the wider context of changes in UK agricultural policy. Environmental degradation is receiving greater attention resulting to a shift in agricultural policy towards requirements for improving environmental protection. This process is part of a more general shift in policy at European level, as demonstrated by recent changes to the European Common Agricultural Policy (CAP), whereby farmers receiving financial support will find it necessary to meet environmental, food safety and animal welfare standards in order to receive financial support. Biotechnology is viewed in the UK as a way of increasing agricultural efficiency and attracting investment to create a more competitive industry. However, there is concern that its implementation may be in conflict with measures, such as the UK Biodiversity Action Plan (Department of Environment, 1994), that are designed to protect the environment.

When GM crops were proposed for commercialisation, issues concerning their impact on biodiversity came to the fore. In October 1998 the Government announced its intention for a 'managed development' of GM crops and a major obstacle to commercialisation was the controversy over the possibility that broad-spectrum herbicides may be harmful to wildlife habitats. In the UK 69% of the land is registered as agricultural holdings (Countryside Agency, 2002) and there are few remaining 'wild' areas. The wildlife habitats within the farmland are of particular importance both for their contribution to biodiversity and as part of our cultural landscape heritage.

In response to these environmental concerns, in 1999 the expertise within the scientific advisory body on releases to the environment, ACRE, was broadened to include agro-ecological expertise and members with direct links to the biotechnology industry were not reappointed. The Farm Scale Evaluation research programme was established and Industry agreed to wait until the results were known before attempting to commercialise the crops. However, as a precautionary measure the Farm Scale Evaluations (FSEs) have been controversial. Rather than settle these environmental matters, as originally intended, they have intensified debate by providing a focus for people's concerns.

Although the regulatory authorities and industry have remained convinced of the safety of GM crops as regards human health and are convinced of their benefits, others are not. In addition to fears about the environment, those critical of GM crops have expressed wider concerns over issues such as the economic effects and their social and ethical implications. In response to concerns that issues beyond the science should be addressed, in 2000 the Government set up the Agriculture and Biotechnology Commission. The AEBC has been influential in making apparent people's concerns and the limitations of a narrow scientific risk assessment. In a key report on the Farm Scale Evaluations, 'Crops on Trial' (AEBC, 2001b), the AEBC highlighted the way that a more participatory approach would draw to the Government's attention the importance of issues of concern, such as the adequacy of the risk assessment procedures, separation distances and the need to protect the interests of organic farmers, and provide greater understanding. Acting on advice from the AEBC, in 2002 the Government commissioned a formal public debate on GM crops.

Under pressure from environmental NGOs and following advisory body advice, biotechnology regulation in the UK has involved a general process of broadening expertise. Concern over GM crops has led to strategies for precautionary commercialisation (see Levidow & Carr, 2000) with the Government seeking to be seen to be open, considering more uncertainties and therefore making more legitimate decisions.

Currently the Government remains committed to the Bioscience industries and new innovations as a way of maintaining the nation's wealth. The science base is viewed

as vital for building a knowledge driven economy (BIGT, 2003) and for providing the evidence for evidence-based policy making (Levitt, 2003). Further, following controversies in the agricultural sector over BSE and Foot and Mouth disease, the Government has been keen to be seen to be more open and transparent, making legitimate discussions and providing 'balanced' regulation. Considering all this evidence and following the advice from ACRE, on the 9th March 2004 the Government outlined its 'precautionary approach' to GM crops. One crop involved in the Farm Scale Evaluations, GMHT maize, was given the go-ahead for commercialisation, subject to certain conditions.

This report considers the recent 'precautionary approach' to commercialisation of GM crops adopted by the UK. Drawing on information gathered from documents released by the relevant policy actors, face to face interviews, telephone conversations/interviews with a range of representatives from Government, farmers groups and environmental non-government organisations (NGOs) (see Section 4), the report considers how precaution and precautionary practices are framed. Section 2 of the report considers how the precautionary principle is cited or used in practice by different policy actors. Section 3 provides more detail on precautionary approaches under three institutional practices – regulatory measures, expert judgements and stakeholder roles.

## 2 Precaution: use of the precautionary principle

Although the precautionary principle is widely used at both the national and international level, as noted by the Food Ethics Council (2003), it is only loosely defined in policy. The EC Communication on the precautionary principle (EC, 2000), setting out guidelines for the use of the precautionary principle, comments that they are only intended 'to serve as general guidance'. Interviewees from all stakeholder groups for this project (see Annex II) felt that the Commissions document was useful, but there was general concern over its use as a practical tool. As one interviewee commented:

'I think it is a useful document, but I have to say I don't know much about it compared to other legislation, but it does seem to be quite a useful tool'...  
'Speaking personally, as I was saying before, the precautionary principle is almost a theory or a mechanism of regulation or governance that almost seems to be one step removed from the kind of things that a person might be doing in their every day lives'.

In the UK there is general awareness among policy actors of the precautionary principle, however, there is no agreement on what it means or how it should be implemented. The people interviewed for this project generally felt it was important to debate the meaning of the principle, and some organisations have been working to produce their own interpretations of its meaning.

A series of seminars with NGOs, business and Government on the precautionary principle in practice (see Willis and Oldham, 2002) also concluded that although the precautionary principle generally is used to justify or criticise decisions of scientific uncertainty 'there is no clear agreement on what it means in practice'. However, within the differing views the seminars found a clear consensus emerging between business, NGOs and Government as to the essential elements of precaution (see Table 2).

**Table 2 Consensus among NGOs, business and Government about how a precautionary process should work (from Willis & Oldham, 2002)**

- Precaution is part of, not instead of, good science.
- Continuing scientific monitoring and research is essential.
- Tools such as risk assessment and cost-benefit analysis should be used in context.
- There is a need for genuine stakeholder and public involvement.
- Openness and transparency is central.
- A precautionary decision-making process will not necessarily result in a ban – there is a range of possible outcomes

The following sections consider different policy actors' views on the use of the precautionary principle both generally and in relation to GM crops.

### 2.1 Government and the precautionary principle

The Government's Sustainable Development White paper sets out their commitment to the precautionary principle as set out in the 1992 Rio Declaration. While there are no Government plans to issue any guidelines on the EC Communication on the precautionary principle (DEFRA interview), guidelines have been produced for use by government departments on the use of the principle within its own departments. Elaborating on the guidelines set out in the EC communication, the Inter-

Departmental Liaison Group on Risk Assessment (ILGRA) who advises Government on risk policy have issued guidelines in an attempt to gain a consistent approach within government departments (ILGRA, 2002). The guidelines recognise that there may be different strengths of precaution (see Table 3).

**Table 3 Contrasting views of precaution (source: ILGRA, 2002)**

<b>'Weak' precaution</b>	<b>'Moderate' precaution</b>	<b>'Strong' precaution</b>
Presumption of unfettered market-led development and technological innovation.	Underlying presumption of unfettered market-led development and technological innovation, but recognition that this can sometimes be overthrown where there are high levels of societal concern.	No presumption of either market led or technologically driven development.
Regulators intervene only where there is positive scientific evidence of risk and intervention demonstrably cost-effective.	Presumption of intervention as under 'weak', but case by case flexibility to shift the onus of proof towards the risk creator.	Risk creator demonstrates safety of activity. Little credence in cost effectiveness.
Presumption of risk management. Banning very rare.	Underlying presumption of risk management. Banning possible, but a last resort.	Presumption of risk avoidance. Banning likely.
Presumption of free trade on the basis of objective scientific criteria. Individual preferences and societal concerns given no weight.	Underlying presumption of free trade on the basis of scientific criteria. Recognition that individual preferences and societal concerns matter.	No automatic presumption of free trade. Individual preferences and societal concerns dominant.

ILGRA make a distinction between the precautionary principle and other drivers for caution. The precautionary principle is perceived as being narrower, more specified, than 'being cautionary'. Being cautionary may apply even when there is little scientific uncertainty but the nature of the hazard, or those affected, reduces society's tolerance to risk, or when there is a desire to overestimate the risk, for example, over-engineering of bridges.

With respect to GM crops, ACRE, the scientific body in the UK responsible for advising Government on the risks to health and the environment of the release and marketing of GMOs, are assumed to take the precautionary principle into account in their decisions and are not given any formal guidance on it. They are considered an independent body to the Government and it therefore does not seek to influence them, although they are provided with risk assessment guidelines, which may need updating in the future.

The Governments approach to the use of the precautionary principle is not without criticism. Some Government advisors have been critical of the way that the principle as set out in the EC Communication is frequently forgotten, not understood and neglected by people. As one scientist interviewed commented:

'the term 'the precautionary principle' has become devalued by being redefined each time it is used by a different group for their own purposes'.

For him the precautionary principle is a clearly developed methodology which is not being used by ACRE in any rigorous way. He comments that NGOs have never bothered to understand or use it while industry talks about it but does not know what it means. Some of the blame is believed to lie with the EC who having worked hard to develop the precautionary principle Communication, then did not bother to promote it. However, for the Government, who maintain that they are neither for nor against the introduction of GM crops in general, the commissioning of large scale farm scale evaluations, measures such as thoroughly reviewing the scientific evidence and costs and benefits and funding a national formal public debate, are considered to represent a 'scale of precaution we don't apply to anything else' (M. Beckett Hansard 23 October 2003).

## **2.2 The precautionary principle beyond Government**

Many of the precautionary concerns of those worried about or opposed to GMOs are not just about the science and safety issues, but concern processes, such as the independence of risk research, the lack of inclusion of the socio-economic issues or ethics in the assessment process, the threat to farming as a business, the impact of agricultural intensification (changing farming practices as well as crop traits) on biodiversity, and the way that monitoring will be implemented. This section considers the concerns of industry, farmers' organisations and environmental NGOs.

### **2.2.1 Industry and the precautionary principle**

Generally, Industry has developed its own precautionary approaches, either in the form of set guidelines or codes of conduct (e.g. Federation of the Electronics Industry's Ten Commitments drawn up in response to uncertainties over mobile phones), or as a necessary part of the process of product research and development.

Industry representatives argue that an adequate risk assessment and management procedure means that there is no need for further actions based on the precautionary principle. Although generally supportive of the principle, industry is concerned that a lack of clear criteria for its use can lead to abuse and hinder innovation. They argue that political and emotional factors are favoured above scientific considerations. The European Crop Protection Association, for example, takes the view that 'Improper use of the precautionary principle can lead to a hindering of scientific and technological progress' (ECPA, undated). This is also the view of the UK Crop Protection Association who call for accepted guidelines and consensus on interpretation of the precautionary principle.

For industry, precaution is considered to occur at all stages of product research and development. Industry representatives argue that they would not wish to promote a product that would be unacceptable to the market and that many products do not make it though the first 2-3 years of a typical 10 year development period. While interviewees felt that industry is aware of the EC document on the precautionary principle they did not think that generally it was actively discussed in the context of GM crops. At the regulatory level, the regulatory authorities are relied on to consider the principle. One interviewee commented that 'if more information is required by the regulators then that is provided'. He also pointed out the way that industry has been actively involved in strengthening the requirements of the regulatory system, for example in the case of pesticides.

Industry representatives consider that there is no significant evidence of harmful effects due to commercialisation of GM crops in other countries and that they may even be safer than conventional crops, (see for example, House of Commons 2002b, Annex). Measures such as the FSEs, where the technology has been put before the scrutiny of independent scientists, are felt to demonstrate a commitment to openness and to basing decisions on the best available scientific evidence. They have criticised arguments of those against the commercialisation of GM crops in the UK. The organic farming lobby are accused of inflicting their ideological position on other farmers for their own commercial advantage and deliberately employing strategies to delay planting. Issues such as public acceptability are considered to be part of the

market place and not the responsibility of regulation. Whereas the Soil Association, consumer organisations and other NGOs are concerned that an assessment process should weigh up the costs and benefits to consumers, industry does not see this as the role of regulation. For example, one industry representative commented:

'I think it is not the role of regulation to determine whether or not there are tangible consumer benefits but to establish whether they're safe and whether a clear choice can be provided...'. (D. Pearsall, Q73, House of Commons 2002a).

Industry representatives acknowledge that there are currently no obvious direct benefits to consumers of GM crops, but point to future potential benefits, such as bio-fuels and specialist oils, and to their ability to help farmers compete in the market place (abc, 2003a).

## **2.2.2 Farmers' organisations and the precautionary principle**

For farmer organisations, there are issues of responsibility towards, different types of farmers and to their customers. The diversity of the farming sector is reflected in the large differences between the different farming organisations in the UK regarding GM crops. Organisations representing farmers have been perceived as being highly polarised (FARM, 2003). Adequately representing a wide diversity of farmers interests and hence diversity of views on GM crops, is noted by the National Farmers Union as a particular problem (interview). The National Farmers Union (NFU) has a position within SCIMAC, an umbrella organisation for the farm supply chain set up to support the introduction of GM crops, and is largely in favour of commercialisation of GM crops. By contrast, organisations such as the Small Farms Association – representing small farmers, the Welsh Farmers Union, and the Soil Association – representing the organic producers, are against commercialisation.

The NFU interviewee advocated a consistent approach to precaution, commenting that it would be useful to have a 'set of principles that you can tick boxes'. For them a key part of taking precautionary measures is the need for more research, to fill in gaps in present knowledge, although how much evidence would be enough would depend on the individual circumstances. Important uncertainties for farmers do not just concern the science, but also uncertainties over public acceptability and over potential restrictions in farming practices. Of particular concern is the co-existence of different types of agriculture and who accepts responsibility when things go wrong. As noted by one member of FARM, a campaigning organisation for the interests of independent and family farmers:

'When the Biotech companies are prepared to accept UNLIMITED liability, on a corporate and personal scale, for the consequences of letting GM loose, their supposed advantages can be considered. Until then, no thanks'. (<http://www.farm.org.uk>)

For the Soil Association, as GM and non-GM crops are simply incompatible, precaution should not be an issue. They comment that the Government is ahead of itself and 'has taken the final step before it has taken the first step.' (P. Holden, Q56, House of Commons, 2002a). The Soil Association's objections are similar to those of other environmental NGOs. They are to do with 'the risks and dangers of unforeseen consequences both to the environment and to human health, the denial of choice and the incompatibility of genetic engineering with what we see to be the principles of sustainable agriculture.' (P. Holden, Q7, House of Commons 2002a). Like many environmental NGOs, the Soil Association are concerned that while it is important not to reject an evidence or science based approach, it should be combined with non-evidence-based criteria. They point to the absence of evidence, rather than evidence of absence of risk, and highlight the importance of intuition in decision making. They comment that while it may not be possible yet to measure intuition objectively, 'many hypothesis which were tested by scientists whose names went down in history later, probably will be ascribed to intuitive feelings.' (P. Holden, Q12, House of Commons 2002a). Although the implications for organic farmers maintain a high profile through the Soil Association, the implications of GM crops for conventional farming systems

are also a concern for those farmers with an interest in environmental conservation practices.

### 2.2.3 NGOs and the precautionary principle

For environmental NGOs the precautionary principle is not just viewed as one principle that has to be applied, but as a framework for being precautionary. The important thing for them is how it is put into practice. Green Alliance (Willis and Oldham, 2002) considers three types of precaution: 1) The precautionary principle as defined in the Rio Declaration; 2) A precautionary approach, referring to precautionary action taken as a response to scientific uncertainty; 3) A precautionary process, which is a practical framework for precautionary actions by establishing criteria for decision-making. Others take the view that this is really just semantics. Generally precaution is viewed as a process rather than a rigid set of rules to be followed, and criticisms of precaution in GM issues are concerned with the processes involved in carrying out risk research, assessment and management. Aspects such as openness, transparency, stakeholder involvement and dialogue are all important aspects of precaution in practice.

The Consumers' Association are concerned about the need to put health and consumer interests first (Consumers' Association, 2002). Reports by both the Consumers' Association and the Green Alliance emphasise the need for openness and inclusiveness, however, the Consumers' Association consider what constitutes taking a precautionary approach rather than a process and focus on the point at which precautionary action should be taken. They argue that it is 'essential that precaution is integral to the entire risk analysis process including the way that risks are assessed and the way that risks are communicated' (Consumers' Association, 2002).

#### **A precautionary approach is about:-**

- Exposing uncertainties;
- Shifting the focus to what we don't know;
- Making any assumptions or judgements explicit;
- Ensuring that all of the possible options have been considered;
- Being inclusive;
- Taking a long-term rather than short-term approach; and Ensuring measures are proportionate.

(Consumers Association, 2002)

Green Alliance suggest that one way of applying the precautionary principle in practice is to embed the principle in guidelines such as codes of conduct and government guidance to help to build a 'library' of uses. In this way the principle could become a basis for legal action through judicial review or corporate liability (Willis and Oldham, 2002). They also suggest the term 'reasonable action' as a more useful concept than 'proportionality', because quantifying risk is impossible in cases of scientific uncertainty.

The environmental NGOs interviewed felt it was important that the EU's communication acknowledged socio-economic impacts and non-economic considerations as relevant, and also the need for transparency and dialogue with all stakeholders. Applying precaution to GM crops means addressing the serious omissions in the regulatory process before commercialisation should be considered. For some organisations, for example, the Food Ethics Council, the precautionary principle represents an opportunity to re-consider the foundations on which the current regulatory regime is based:

'The precautionary principle highlights the ethical requirement for a radical rethink of regulation and a moratorium on GM crops should remain in place pending the completion of this process. Truly precautionary regulation must take the assessment of risk 'acceptability' as seriously as evaluation of the level of risk'. (Food Ethics Council, 2003)

A comparative approach is advocated by NGOs, where the alternatives are weighed up, particularly between GM and non-GM options, and the uncertainties in the science are taken into consideration. It is felt that a broader range of people should be brought into the risk assessment process and that a more holistic approach was necessary. As commented by one NGO director:

'the precautionary principle should be referred to at all stages, ranging from potential damage caused to natural organisms to ecosystem disturbance, it includes wild plants and organisms, the effects on genetic diversity, species integrity and concern for future generations'.

For organisations subscribing to the Five Year Freeze, who aim to maintain the moratorium on the commercialisation of GM crops (see Section 3.3), GMOs possess potential risks and no real benefits and therefore we 'should proceed on the basis of precaution'. They argue that 'the Government has done very little to take a precautionary approach' (Five Year Freeze, 2001) as they have not refused or suspended any marketing consents despite concerns. A precautionary approach would mean taking a number of actions such as the withdrawal of marketing consents for all GM foods until there has been a review of their safety; ending of the use of substantial equivalence for testing GM safety; introducing a monitoring scheme that determines short and long-term effects of eating GM foods; introducing safety regulations for GM animal feed and assessing secondary effects e.g. herbicide residues present in GM plants.

While industry puts faith in the Government to apply the precautionary principle in the regulatory process, NGOs are critical of what they perceive as 'expert' led, top-down approaches to risk management, and the lack of recognition of broader societal concerns. 'Experts' are viewed as being insulated from the risks. Communication is therefore an important part of a precautionary process for this group, who feel that it is not taken seriously by Government. This was noted by the National Consumer Council (2002) who commented that 'traditional risk communication typically sees the process as an add-on at the end of the risk management process', exemplified by 'we make the decision and then we tell you what the decision is'. They are critical of the 'one way dialogue' – that communication is frequently in the form of information provision.

## **2.3 Emerging perspectives on precaution for GM crops**

There are many of perspectives on GM crops in the UK covering the whole spectrum of views. At one end are those who perceive GM crops as merely an extension of an already highly developed seed technology. Therefore, it is of no more concern than conventional seed technology which is already highly developed. They point to the benefits that GM crops can provide both for the environment and for food security. Potential problems with GM crops are considered in the context of problems already experienced with 'conventional crops' and the threats to biodiversity are considered in contrast with threats from other sources, for example, from non-native invasive species. At the other end of the range of perspectives are those who view genetic modification as a large step in intervention. They point to the uncertainties and limitations of current knowledge, even with conventional agriculture. They believe that the risks are at present too great to allow commercialisation to proceed, although many do not rule out their future use. These different perspectives on GM crops offer a multidimensional view and serve a valuable purpose in the negotiation over the path that society should take, and a way to explore different options.

Clear themes emerge across different groups when people are considering precaution, whether this is concerning GM crops or precaution in the face of scientific

uncertainly generally (see Table 4). They highlight the way that precaution in the UK is operating as a process rather than as a set procedure.

**Table 4 Emerging perspectives on precaution and GM crops**

<b>Emerging perspectives – key themes</b>	<b>Examples from documents and interview material</b>
<b>Precaution as proceeding with care</b>	Precaution is something people do anyway, that they exercise all the time. Industry does it already with new products. Precaution is about 'proceed with great care' – the precautionary principle is exercised all the time in areas where there is incomplete knowledge.
<b>Precaution as good science</b>	It is a necessary part of good scientific practice.
<b>Precaution as a rational approach/framework for decision making</b>	Implementing the precautionary principle should not be based on emotions. Some stakeholders are particularly keen that a greater following for the EC's communication on the precautionary principle will lead to a more rational approach to decision making. Arguments against irrational precaution refer to the way no harm has happened yet – no detrimental health effects, no contamination of organic agriculture during field trials.
<b>Precaution as a means for greater openness</b>	Transparency is particularly important for NGOs and farmer groups. For example, calls for results of any monitoring programme to be in the public domain. The AEBC is a good example of attempts at openness in Government advisory committees.
<b>Precaution as a mechanism for placing policy decisions within a societal context</b>	We should question the need for the technology in the first place. It should also mean the inclusion of an evaluation of all possible options. Precaution should involve widening decisions beyond a narrow scientific base.
<b>Precaution as a pretext</b>	The public debate will be indecisive, Government will use it to back their decision either way.
<b>Precaution as inclusive</b>	Precaution means including more views. The public debate is viewed as playing an important role in opening up the debate.
<b>Precaution as fair</b>	The costs and benefits of GM crops are not necessarily evenly distributed. NGOs call for consideration of this in the assessment process.
<b>Precaution as a means for stifling innovation</b>	Concern that the precautionary principle will be used to prevent technological developments. Commercialisation of GM crops will go ahead, it is just a question of time. The precautionary principle should not be invoked to slow development down.
<b>Precaution as a delaying tactic</b>	Precaution is viewed as slowing things down, to delay the decision-making process for as long as possible. Given time the public will change their views and this will be reflected in Government decisions.
<b>Precaution as an iterative and flexible process</b>	Moving with the situations as they change, as the technology develops. Precautionary measures need to be flexible, they need to be appropriate to the different products and contexts.
<b>Precaution as a reputation enhancer/as demonstrating responsibility</b>	Business may utilise precaution to demonstrate their ability to be responsible. There is a growing realisation that it is an essential element in the corporate environment. Growing concern over the way that NGOs/media conduct themselves in GM debates – calls for greater responsibility.
<b>Precaution as a long term view</b>	Provides an opportunity to consider the future – should be a long term rather than a short term view.
<b>Precaution as irrelevant</b>	No commercialisation of GM crops would mean there is no need for precaution.

## **2.4 The precautionary principle as a tool or mindset, toolkit and/or process**

Both a 'toolkit and process approach to precaution operates in the UK. A 'toolkit approach i.e. as a set of rules to be applied, has attractions for those who are engaged in the practical implementation of the precautionary principle. Although some organisations have used the EU guidelines to develop a precautionary approach relevant to their own particular needs, the precautionary principle is not necessarily articulated as such, but is more an underlying feature of people's perspectives. It was generally considered, by people interviewed for this project, to operate at all levels and across time. They rarely use the word uncertainty in the narrow way it is used in the EU document and consider precaution as more a general way of acting rather than something to be triggered. Thus while Government and industry may prefer a 'toolkit' approach to the precautionary principle, it is more often a context or mindset for making decisions. A tension therefore exists between the need for more formal, stable approaches to precaution, as set out in the European Commission's Communication (EC, 2000), and a more open process, i.e. between something which is triggered and something which is a more general way of acting.

Precaution for GM crops in the UK is an ongoing process, drawing in more expertise, both strategically and unintentionally, and creating new institutional practices. The following sections consider this process in detail, commenting on developments in the UK under three institutional practices – regulatory measures, expert judgements and stakeholder roles.

### 3 Three institutional practices

In a statement on Government policy on GM crops (DEFRA 2004a), Margaret Beckett the Secretary of State for the Environment and Rural affairs, announced its 'precautionary approach' commenting that:

'I believe the approach I have outlined today is the right one. It is precautionary. It is evidence-based. In practice it means licensing one application, which runs till October 2006, and is subject to two further conditions'.

She added that she had examined all the concerns raised about the commercialisation of GM crops, and the UK should oppose EU approval of commercial cultivation of HTGM beet and oilseed rape, using the regime as tested in the FSEs, anywhere in the European Union. However, she agreed in principle to the commercial cultivation of GMHT maize, subject to GMHT maize only being grown as in the Farm Scale Evaluations (FSEs) or under conditions that will not result in adverse effects to the environment. In response to the concerns over the phasing out of the herbicide atrazine, consent holders would also be required to carry out further scientific analysis to monitor changes in herbicide use on conventional maize and submit new evidence if renewing their existing marketing consent which expires in 2006. Margaret Beckett noted that FSEs and other research carried out into issues concerning GM crops raised far reaching questions for crop management and the environment.

While industry representatives have welcomed the Government's decision as a step forward, they remain concerned that the decision is very cautious. Environmental NGOs accuse the Government of failing to listen to the views of consumers and point out that the risks outweigh the benefits. The director of Friends of the Earth, for example commented:

'The government has given the thumbs up to GM maize, and shown two fingers to the British public. In demonstrating its pro-GM credentials, the government has ignored considerable scientific uncertainties, show contempt for parliament and utterly disregarded public opinion'.

Bayer CropScience has since announced that it will 'discontinue further efforts to commercialise GM forage Maize in the UK (Bayer news release, 31 March 2003). The Government placed a number of constraints on this approval before the commercial cultivation of GM forage Maize can proceed, thus provoking the company to announce that:

'The specific details (of the conditions) are still not available and thus will result in yet another 'open-ended' period of delay. These uncertainties and undefined timelines will make this five-year old variety economically non-viable'.

The following sections consider the different perspectives in the UK on GM crops and events that led up to this decision. The UK's 'precautionary approach' is considered under three institutional practices – research, expert judgements and stakeholder roles.

#### 3.1 Regulatory measures

##### 3.1.1 Research

In line with a wider move towards more evidence-based approaches to policy decisions in the UK, the Government has been keen to ground any decision on GM crops firmly in evidence, particularly scientific evidence. Annex III lists some of the recent scientific research. The most significant scientific research study undertaken has been the Farm Scale Evaluations. A review of the science for GM crops and an

analysis of their costs and benefits have also been carried out. These are discussed in the following sections.

### **3.1.1.1 The Farm Scale Evaluations of GM crops**

The Farm Scale Evaluations (FSEs) research programme began in 1999. As previously noted, it followed debate concerning whether GM crops tolerant to broad-spectrum herbicides would lead to increased weed control and therefore less resources for farmland wildlife to feed on. The evaluations investigated how growing genetically modified crops might affect the abundance and diversity of farmland wildlife as compared with conventional varieties. They represented the world's largest GM crop field trials (Burke, 2003). ACRE also identified the possibility, although still considered unlikely, that gene flow may confer an ecological advantage to plants outside the agricultural environment. Thus gene flow studies were also included alongside the FSEs. At the time, agreement with the farming and industry group SCIMAC was reached that no commercial cultivation of GM crops would take place until the end of the FSEs (DEFRA 2002a). The FSEs were originally intended to settle matters regarding biodiversity issues and GM crops, and so enable commercialisation of GM crops to go ahead. However, following their commencement they became the subject of controversy and were clearly not able to provide the only basis on which Government could make a decision.

The FSEs lasted for 4 years and cost around £5 million. They were run by a Scientific Steering Committee of independent researchers and conservation representatives. A total of 273 fields in England, Scotland and Wales were involved, planted with maize, beet and oilseed rape (spring and autumn sown). A GM maize (T25) already had a 1998 marketing consent under Part C of the European Directive and beet and oilseed rape have pending applications for Part C and were being grown under research consents. The last harvest was in 2003. The results of the research have been published although the report for a fourth crop, winter sown oilseed rape, which is the crop most commonly grown in the UK, are not expected until later in 2004 (House of Commons, 2004).

The results of the FSEs indicated that following herbicide applications to GMHT 'beet and spring oilseed rape crops, weed biomass and seed rain were one third or less than corresponding amounts in conventional crops, resulting in smaller seed banks.' For maize, biomass and seed rain of dicot weeds were higher for the GMHT crops, with little evidence of effect on the seed banks (Firbank et al., 2003, The Royal Society, 2003). The researchers concluded that growing GMHT beet and spring rape on a large-scale may therefore disadvantage wildlife and exacerbate the long-term declines of flowering arable weeds. Growing GMHT maize may benefit farmland birds. The researchers note that generally the results emphasise the importance of farm management practices, as the extent of the effects found would be dependent on how yearly crop rotations were managed (Burke, 2003).

In November 2003, the wider scientific community and others interested were given the opportunity to comment on the results as part of the debate on commercialisation. ACRE then advised Ministers of the scientific significance of the results. They agreed with the FSE researchers and reported that growing GMHT maize would not result in adverse effects, while beet and oilseed rape would result in adverse effects compared to conventional crops (ACRE, 2004). However, they emphasised that these results are only applicable when crops are grown under the same management regime as in the FSEs. In light of the phasing out of the use of atrazine, ACRE advised that further studies be initiated immediately for GMHT maize and the introduction of new weed management regimes for non-GM maize. The House of Commons Environmental Audit Committee, which is made up of members of all political parties, has also recommended further trials for maize. The Committee questioned the validity of the FSEs results for maize because of the use of atrazine, and recommended that commercial planting did not occur until the crop had been re-trialled. They further noted the indecisive nature of both the FSEs and ACREs advice, commenting:

'the advice from ACRE is clear but it is not decisive. We acknowledge that in its limited scope and contingent nature, the ACRE advice accurately reflects the trials themselves'. (House of Commons, 2004).

#### *The FSEs as a precautionary measure*

For some of the interviewees for this project, the Farm Scale Evaluations (FSEs) represent a good example of the precautionary principle in action, with the Government carrying out what is required to ensure that it is able to defend its position in the European Union. The National Farmers Union have been supportive of the evaluations and are a member of SCIMAC, a joint farmer and industry initiative that have developed management protocols for the FSEs. However, the NFU cautioned that farmers may not choose to grow GM crops, particularly if there were no consumer demand (NFU 2003a). For industry the FSE results were considered to 'confirm what industry has long argued' (abc 2003c). The chair of the industry alliance the abc, commented that:

'Activist groups claim that GM crops were in effect 'green concrete' and would 'wipe out' wildlife. These studies show that this sort of scaremongering is not supported by the evidence. On the contrary – this evidence show that GM crops are more flexible and can enhance biodiversity'. (abc 2003c)

Others welcome such precautionary efforts, for example, Friends of the Earth comment that:

'Changes to biodiversity may be serious and possibly irreversible and so fall within the scope of precautionary action'. (FOE, 2003)

However, they are also vocal in their criticisms of the FSEs. Michael Meacher MP, the former Environment Minister, has been particularly out-spoken in his criticisms commenting that:

'the trials were artificial and manipulated to bring about a desired outcome'. (Red Pepper, Dec. 2003)

Mr Meacher pointed out that the use of the subsequently banned chemical atrazine in the maize experiments meant that these results are no longer valid. He further commented that the management practices of the farmers did not mimic what would occur in real life, for example, farmers were advised to carry out only one spraying of herbicide allowing weeds to grow again, whereas he considered that in real life they would spray more often.

Critics have been concerned that the results provide only limited data and not a definitive risk assessment. Throughout the FSEs they have commented on the lack of investigations into the impact on soil, earthworms, fungi and bacteria; that no baseline studies for biodiversity exist so changes in species diversity cannot be examined; that long-term effects cannot be considered; that separation distances are inadequate to avoid cross-contamination of organic and non-organic, and that there is a lack of consultation with neighbouring farmers or beekeepers. They have also raised questions over the scientific methods used, such as the indicators for biodiversity. Friends of the Earth have been particularly concerned over the ability of the FSEs to detect ecologically important differences and the relevance of the results once the number of farms is scaled up (FOE, 2003).

Following the FSE results peoples concerns were discussed at special ACRE meetings. Concerns raised in peoples submissions to ACRE included:

Crop yields were not reported in the FSE results, which could lead to underestimates of the impacts of management practices if yields of the GM crops were not as high as non-GM crops.

The FSEs potentially misrepresented herbicide usage. They may represent minimised impacts of herbicides on biodiversity as farmers may alter weed management regimes in order to achieve better weed control. Or close scrutiny of farmers may have led to farmers using less chemicals than they may otherwise have done.

That the wider environmental and health effects were not included, neither was a comparison with organic farming.

Birds and other relevant species such as earthworms were not directly studied (ACRE, 2004).

That farmers may not adhere to restrictions in herbicide use and how this would be monitored.

Importantly, the FSEs raised questions about agricultural practices more generally, particularly concerning the effects of non-GM crops on biodiversity.

Particular criticism of the FSEs were dealt with by the House of Commons Environmental Audit Committee who also noted that they were 'unhappy' with way the North American experience had not been factored into the decisions on GMHT crops. Although they applauded the steps to assess biodiversity impacts, they criticised the Government and its advisory bodies for their view of 'harm' commenting;

'... we believe that even if some GM crops with some associated herbicide regimes are eventually shown to be less harmful to biodiversity than their conventional counterparts, the government and its advisory bodies are still guilty of setting too low the level of harm'. (House of Commons, 2004)

While NGOs have viewed the FSEs as a trial on GM crops, ACRE have always maintained that this is not the case, as noted by one interviewed ACRE member:

'The purpose of the farm scale evaluations is to test the effect on farmland biodiversity of change in management practices associated with the use of herbicide tolerant crops. This is not a GM issue and it is irrelevant whether the crop is GM or not'.

For industry the FSEs were also not about a 'trial of GM'. The abc (see Section 3.3.2) in their statement on the results commented that:

'genetic modification is a tool which can be used in different ways with different management practises resulting in different outcomes', further adding that 'none of the studies published this year support the banning of any GM crops'. (abc web site)

That the FSEs provide only part of the environmental impact assessment has been recognised by Government who have stated that they 'are only one part of the decision-making framework' (DEFRA 2002a). Although, as the only remaining concern of ACRE in their scientific assessment of the commercialisation of the GM crops has been potential risks to biodiversity associated with the use of herbicides, there is limited room for manoeuvre within the Government's obligations to comply with the EU directive.

### **3.1.1.2 The GM Science Review**

The Science Review was specifically concerned with the potential use of GM crops in the UK and did not aim to be an exhaustive survey of all that is known. As part of its remit it was 'driven' by public interests and concerns and gave special attention to uncertainties, unknowns and gaps in knowledge. It examined what is the evidence for harm and also the evidence of absence of harm (GM Science Review Panel, 2003). The panel was chaired by the Governments chief scientist and the evidence was assessed by a broad range of specialists, non-specialists and social scientists. Using a consistent framework the following aspects were considered:

How reliable GM plant breeding is

The safety of food and animal feed derived from GM crops

Environmental impacts

Gene flow, detection and impact

Key findings of the report were:

that there were no known health effects from GM foods, but that 'absolute safety does not exist'

regulation should proceed on a case-by-case basis

further research is needed on food allergies, potential changes in soil ecology, farmland biodiversity and the consequences of gene flow.

The report concluded that there was no evidence to support an outright ban on growing GM crops, but neither should there be blanket approval. It stressed the way uncertainties are part of the introduction of any new technology.

The report was considered by both sides of the debate to be in support of their particular viewpoint. In their response to the report the anti-GM lobby commented that it recognised the limitations of the technology and testing regime and reiterated their concerns about the experimental nature of such a new technology. English Nature was encouraged by the way it highlighted the potential effect on farmland wildlife as a key issue. Industry representatives welcomed the confirmation of the requirement of a case by case approach to regulation. They felt that the report endorsed their view that there are no expected or observed effects on health and that the crops were safe. This was endorsed by the authors of the report, who point out that the root of the problem is not the GM crops but the herbicide regime (Giles, 2003).

### **3.1.1.3 The Economics Study**

At the same time as the Science Review, a study of the economics was also commissioned. Like the Science Review the study considered the views of experts and the wider public and was carried out by a multidisciplinary team. It also considered the economic impacts in other countries. The report did not take a conventional approach to cost benefit analysis, rather it assessed the costs and benefits of GM crops in the light of their impact on a number of policy objectives – agricultural policy and the environment; rural policy; science, innovation and competition policy; policy on food safety and quality, and international development policy (Strategy Unit, 2003). Adopting a scenario approach, the study considered both present day GM crops and those which could be on the market in the next 10-15 years. Their analysis considered how the impact of GM crops would be felt across five different potential futures.

The study concluded that:

A future with or without GM crops will entail trade-offs between costs in one area and benefits in another. For example, between the impacts on conventional or organic farmers, or between extensive costly testing and discouraging industry from risking investment in new and potentially useful technologies. This will inevitably involve value judgements.

Any economic benefit is likely to be limited in the short-term.

Public and consumer attitudes are of central importance, for example, in limiting demand for GM crops or demanding segregation of GM and non-GM products.

There is significant potential for benefits from future developments, but current crops would not yield significant benefits and did not have significant benefits for consumers.

International implications could be significant of UK or EU decisions.

The report drew attention to the lack of research on the economic and environmental impacts of conventional and organic farming, thus making it difficult to establish a baseline. It called for further research, recommending that 'a stronger evidence base be built on alternatives to the commercial cultivation of GM crops' to provide a benchmark for satisfactorily analysing the costs and benefits. The report also calls for further research on the 'sociology of attitudes to GM crops and foods' and into the costs and benefits of GM crops in developing countries.

Policy actors from both sides of the GM debate drew out aspects of the report that supported their view. For environmental NGOs the report was perceived as a step towards the Government ending its commitment to GM crops and considered that it confirmed their view that there is little economic justification for commercialisation of GM crops (see for example, FOE press release 11.7.03). The industry alliance, the abc, stated that they 'welcome the publication of the Strategy Unit's Economic report on GM crops and fully agree that existing commercial GM crops would offer 'cost and convenience advantages to UK farmers' when introduced commercially' (abc press release 11<sup>th</sup> July 2003).

#### **3.1.1.4 Research endorsing views**

Research is therefore not simply providing scientific evidence, it is being used to endorse different opinions and further fuel debates. The results of the FSEs have been welcomed by all policy actors and both sides of the debate have used the results to highlight their own position on GM crops. The Welsh Assembly considered the results vindicate their anti-GM position commenting:

'It would appear that the outcome of the FSEs supports the Assembly stance of taking the most restrictive approach to planting GMO crops'.  
(Minister for Environment, Planning and Countryside, Carwyn Jones, press release 16.10.03).

Environmental NGOs and consumer groups have been 'shocked' by the effect on wildlife and have called for the GM crops to be banned (BBC news 16.10.03), whereas industry representatives emphasised the importance of the FSE for considering farming practices. Industry welcomed the FSEs results for adding to the existing scientific information on crop management, however they also pointed out that all farming methods have an impact on the environment. While environmental NGOs, the Environmental Audit Committee and the former environment Minister Mr. Meacher, have called for further research as the research on maize used the subsequently banned chemical atrazine, industry representatives have challenged this view. For example, drawing on further analysis led by scientists who analysed the FSE results that were not influenced of atrazine, the abc comments that the withdrawal of atrazine would reduce but not eliminate the benefits of GMHT maize. This endorsed the view of ACRE (abc, 2004).

The same research is often being used to support opposing arguments. For example, groups such as the Soil Association cite both the English Nature (Orson, 2002) and EU reports (Eastam & Sweet, 2002) on gene flow to demonstrate that there is no way that GM crops and non-GM crops can ever coexist. Whereas industry consider such reports simply demonstrate the need for higher thresholds on contamination. Further, distrust in the presentation of research evidence has caused policy actors to draw on their own research into the use of GM crops in other countries, such as the USA and Canada. For example, the Soil Association points to the North American Farmers experiences of widespread contamination of the agricultural and food sector and difficulties with liability (Soil Association, 2002). The industry body, the abc, point to overseas evidence supporting their view that 'the use of GM technology can have real and tangible benefits to farming and the environment. They note that many of the potential 'costs' associated with GM crops are not specific to agricultural biotechnology, but are similar or identical to those associated with the introduction of any new agricultural practice' (abc web site).

### **3.1.1.5 Research as a basis for decision making**

A more open approach has led the Government to concede that current research may be inadequate for making decisions on commercialisation. That there are differing views on the research has been acknowledged. However, while the GM Science Review found that there was no scientific case for not commercialising GM crops, there remains concern over the whether research agendas reflect the public interest and to what extent they encompass the social, economic and political aspects of GM crop technology.

For all policy actors research is a necessary part of precaution, but it is rarely conclusive and frequently highly contested. There is also concern that not enough research is being done. Key issues for further research include gene flow to bacteria in soils or human guts; pest and insect resistance, recombination of viruses or bacteria to produce 'super viruses'; direct effects of toxins on beneficial bacteria, insects etc and potential health risks, for example allergies. Gene-flow is perceived as a key problem area and as a result risk research issues and assessment are focussing on gene-flow and contamination of GM crops by non-GM. There is also concern that there should be more diversity of expertise involved in research. Concern over the independence and hence trustworthiness of GM research has led to some policy actors insisting that more independent public sector research is carried out. Research on alternative approaches to GM agriculture is also considered to be seriously under funded. The Five Year Freeze for example, comments that while in 2000 £4.4 million has been spent on the FSEs only £2.1 million was spent on organic farming research (Five Year Freeze, 2001).

### **3.1.1.6 Research as part of an on-going learning process**

The complexity of the potential impact of GM crops on the environment and society has been highlighted by current research. For example, the Science Review notes that 'We are limited in our ability to predict ecological changes in complex systems' and that there is a 'major need for policymakers to understand how physiological, social and political environment will interface with the new technologies in order to predict potential environmental outcomes.' (GM Science Review Panel, 2003). As the Government commissions more research the need for areas of further research are highlighted. For example, the Farms Scale Evaluations not only provided information on growing HTGM crops, but also highlighted broader issues concerning agriculture and the environment. Future scientific and socio-economic research will be informed by the results of the FSEs, the Science Review and the economics study. They will potentially enable investigations that contribute to a wider view of environmental impacts and are contributing to a broader view of 'harm' (see also Section 3.2.2.2).

The FSEs resulted in a new approach to research in the UK and set an example for future research. Their high profile led to a demand for every aspect of the research to be open to scrutiny and for details, such as the location of the experiments, to be publicly available. They have been heralded as an example of 'best science' (Research Fortnight, 29.10.03). That is, unlike 'normal science' where researchers have to make the best of what little resources they have access to, particular attention was given to every aspect of the FSEs. For example, financial resources were found when needed and measures were undertaken to ensure people with vested interests were not on the peer review panel.

There is a continuing process of broadening research agendas through both the ACRE and the AEBC assessment processes. These bodies have highlighted gaps in knowledge and failings in research policies, such as the balance between public and privately funded research. New government initiatives to involve the wider community in assessment of the available information have highlighted key areas for research, and the importance of supporting research to ensure effective risk assessment.

## **3.1.2 Risk assessment**

In the UK each region – England, Scotland, Wales and Northern Ireland, has its own Competent Authority who relies on the advice of the Advisory Committee on

Releases to the Environment (ACRE) and the Advisory Committee for Novel on Novel Foods and Processes (ACNFP). Risk assessment in the UK has focussed on the commercialisation of herbicide tolerant crops and conventional agricultural practices have provided the comparison. ACRE is responsible for reviewing all applications to release and market GMOs and provides advice to the Ministers on the risks to human health and the environment. In 1999, following concerns over the impacts on biodiversity from organisations such as English Nature and environmental NGOs, the Government sought to widen its risk assessment procedures to include agro-ecological expertise. Consequently ACRE's remit was broadened, as experts in farm systems and ecology were appointed (see also Section 3.2). The ACNFP is a non-statutory, independent body of scientific experts that advises the Food Standards Agency (FSA) on any matters relating to novel foods. It carries out safety assessments of any novel food or process submitted for approval under the EC Novel Food Regulation.

The majority of ACRE's work involves assessing the risks associated with GM plants (ACRE, 2003a). They have produced a number of reports to improve the quality of applications, assessment and monitoring of GM crops (see ACRE web site). ACRE acknowledge that more research is required beyond that of the FSEs, for example on soil biodiversity, however, they remain unchanged over their former judgement that the GM crops grown in the FSEs are no more of a risk than their equivalent conventionally bred crops.

ACRE considers the use of practical options to managing risks, such as preventing cross-pollination through removing flower heads (Science Review Panel, 2003). The committee comments that their approach is to assume that a hazard will occur and to therefore focus on the consequences. The committee admits that their approach is qualitative in nature as the likelihood of harmful effects being realised, and the severity, may be severe, low or negligible, (ACRE Feb. 2001). Through advice and reports, ACRE is employing measures to implement precaution both at an early stage in the development of GM crops and in the field. For example, they has issued guidance on environmental harm in an attempt to improve the quality of applications submitted for approval (ACRE, 2002). The focus is on the scientific aspects of harm e.g. severity, irreversibility, and uniqueness, rather than broader responses such as distrust, equity or legal aspects. Following a consultation exercise, ACRE has more recently published guidance on the design of post-market monitoring plans (ACRE, 2004). Yet, despite ACRE's assurances, critics remain sceptical over the ability of the regulations to control GM crops. Incidents such as when, in 2002, Bayer Crop Science inadvertently planted GM rape seed in trial sites in England and Wales that contained antibiotic material, only add to the mistrust. Assurances by Government that rules will be tightened for future trials, following recommendations by ACRE (2003a), have not alleviated these fears.

For several policy actors the risk assessment process does not go far enough. For example, Scottish Natural Heritage in their response to the consultation on implementation of Directive 2001/18/EC in October 2001 comments that:

'risk assessment should take into account any likely changes in husbandry which would count as indirect and delayed effects'. Scottish Natural Heritage (2001).

They were concerned that new weed problems may not be seen as an environmental impact, yet could result in changes in management practices that affect biodiversity and the environment. They call for indirect impacts, such as weed or volunteer problems to be assessed in environmental risk assessment and also the monitoring plans.

The limited remit of ACRE was also been commented on by the NFU (1998). They argue that advisory panels should formally take account of the wider farming and environmental implications when granting consents to market products. They suggest applying principles similar to those for agrochemical approvals. The Government advisory bodies JNCC/EN also consider rigorous risk analysis should be taken further. That research should include the risks to biodiversity of changes in

agricultural practices, soil processes and other land and water use. They have particular concern for risks to the native biodiversity and feel the use of GMOs should not promote further agricultural intensification. One scientist interviewed commented that such risks should be acceptably low, i.e. should not jeopardise native species or other species in the food web, and there should be adequate safeguards against gene flow between native organisms and GMOs (Johnson, 2001).

For consumer groups and environmental NGOs, that risk assessment focuses on the science and excludes wider socio-economic impacts is unacceptable. Further, they argue that a government risk assessment should be carried out at a much earlier stage in the development process of a technology and include an assessment of costs and benefits. Some of the concerns over assessment of GM crops are demonstrated by the case of T25 maize.

#### **3.1.2.1 T25 maize**

T25 maize – Chardon LL, has been the basis of a hotly contested issue about the scientific evidence on which approval decisions have been based (see FoEE, June 2002). Concern over the approvals process of Aventis T25 maize was instigated by Friends of the Earth (FOE) in 2000, which launched a campaign to prevent it from being added to the National Seed List. Although the Welsh Assembly had objected to it being added, they were overruled by the UK Government. FOE challenged the addition to the seed list using the 1982 Seed Regulations, which allow anyone with 'sufficient interest' to raise an objection. They called for a public hearing which was indefinitely adjourned in November 2000 when it was established that Aventis had failed to carry out adequate basic tests. It was re-opened in April 2002.

At the hearing a number of campaigners criticised the scientific evidence for the maize approval, which was originally given authorisation under directive 90/220/EEC in 1998. However, critics of the hearing were concerned about the lack of publicity, the way the event was run and the narrow interpretation of 'the science' being used. They expressed concern that the Chairman of the event insisted that only the scientific evidence could be considered, thereby divorcing the science from the social and ethical implications (Ho, 2002).

The additional evidence gathered for the hearing was forwarded to ACRE and the Committee on Novel foods. Despite further concerns being raised by the Institute of Science and Society about horizontal gene transfer, hazards of the promoter and transgene instability, ACRE remain convinced that the risk to health and the environment from importation and processing of the maize is no different from that of conventional maize (ACRE, 2003a). The crop has yet to be placed on the national list and the associated herbicide has also not yet received approval under the pesticide regulations.

Thus, despite assurances from ACRE, not all policy actors were convinced of the safety aspects of T25 maize. For the Government the T25 maize case has also highlighted its concern that safety issues are being raised at a late stage in the process. They therefore proposed that representations on safety issues only be made at an early stage in the process and that those affected by the National List, i.e. anyone with concern over growing the new crops, could still make a representation but only in relation to whether the variety is distinct, uniform and stable, and has a value for cultivation, i.e. strictly on the core subject matter of the national listing system.

#### **3.1.2.2 The new Deliberate Release Directive**

Following the EU adoption of the new deliberate release directive 2001/18/EC, In England the Genetically Modified Organisms (Deliberate Release) Regulations 2002 were brought into force on 17<sup>th</sup> October 2002. Similar regulations came into force in December 2002 for Scotland and Wales and for Northern Ireland in April 2003. Prior to this two public consultations were held (see DEFRA web site). The first involved comments from the public on general issues raised by the new directive. In England, these were then used to inform the drafting of the regulations which were subjected to

further consultation (see DEFRA, 2002b, 2001). Consultation exercises were also held in the devolved administrations.

The strengthening of environmental assessment under Directive 2001/18/EC has received support from all policy actors, particularly now that environmental risk assessment includes 'direct or indirect, immediate or delayed' effects of GMOs. This was evident in the responses to the consultation on the implementation of the Directive (DEFRA, 2001) and in the interviews. Some policy actors, however, were concerned that a sound scientific basis for assessment of health and environmental risks was not yet available, particularly a scientific understanding of agricultural ecology and the cumulative effects in the food-chain.

Industry was concerned that the new directive would mean a tougher system that would impede development of the technology, leaving them at a competitive disadvantage. Environmentalists, on the other hand, welcomed a more precautionary regime but felt it did not go far enough (DEFRA, 2002b). For environmental NGOs the new directive does not adequately address socio-economic and ethical issues. They argue that these issues should be considered alongside the science-based issues. The AEBC has also been critical of this aspect (see AEBC 2001b). While industry welcome the use of objective scientific evidence and the case-by case-approach, they remain concerned that unreasonably stringent demands may be placed on applicants. Representatives are keen to point out that 'predicting the future is always uncertain' (Moses, undated). They advocate that the regulations should stress that the risk assessment should be kept proportional to the risk, and that they should not be used as a means for delaying the approvals for non-scientific reasons. In their view, socio-economic issues should be dealt with at a broader level than individual applications (DEFRA 2001).

The public consultation for Part B consents under regulation 18(b) of the directive is broadly welcomed. In the consultation on the Directive this issue received a high response with a broad variety of ways being suggested to engage with the public. However, none of these are reflected in the implemented directive, which relies on advertisements in newspapers rather than open public meetings or letters to councils and groups. While industry supported public consultation, they are clear in their view that public responses should only be allowed on well founded scientific environmental or public health concerns, and that consultation should only apply to Part B consents and not Part C. They expressed concern that consultation arrangements should not be misused to delay decisions (DEFRA, 2002b)

### **3.1.2.3 Crop applications**

A number of applications for Part C consent are waiting approval under the Deliberate Release Directive, of which some are for herbicide tolerant GM crops which might be grown in the UK. GM herbicide tolerant maize (T25) already has Part C approvals and following the FSEs the advice from ACRE remains unchanged.

The UK CA has been responding to assessment reports from rapporteur CAs. It has found applications to be inadequate and has requested further information and conditions to any consent, indicating a UK commitment to ensure that the traceability and labelling regulations can be properly implemented. For example, Monsanto's application to the Netherlands for the import of seed and processing for food and feed of Roundup Ready (glyphosate tolerant) oilseed rape (GT73) applied for by Monsanto. The UK CA has requested:

DNA sequences of the plant genome on either side of the GM insert site and that a risk assessment be carried out on the potential for activation or inactivation of any genes identified.

Clarifications on the use of EcoRI in the molecular characterization as there are inconsistencies in the molecular data presented.

Further details of standard operating procedures that will be used to ensure the seed is not spilled during transit.

Further consideration is given to post-market monitoring plans to monitor for the presence of feral GT73 OSR in imports and during processing and between these locations. Also proposals for action should the feral GT73 be identified.

That the consent holder should be more pro-active and approach end users directly to ask if they have observed any effects on post-market monitoring. Results should be reported to the CA every 6 months for the first 3 years of consent.

### 3.1.3 Risk management

The Government has consulted on post-market (post-release) monitoring as part of the implementation the new directive (ACRE, 2003b) and as noted earlier, ACRE has now published guidance. The Supply Chain Initiative on Modified Agricultural Crops (SCIMAC) a joint farmer and industry initiative, already have a voluntary code of practice that requires farmers to conduct post-release monitoring and report on unexpected effects.

There is an increasing awareness among all policy actors of the importance of farm management for GM crops. Both the Science Review and the economics study note the potential impact of changes in farm management practices. The Science Review highlighted the importance of effective management in a precautionary approach, i.e. to continue to develop safety assessment technology, effective surveillance, monitoring and labelling. The authors note that 'an important uncertainty is how farmers would apply the technology in the field' (GM Science Review Panel, 2003). They further note that 'There is a clear need for more research in these areas (farmer's practices) to monitor uptake and application of new technologies in general and GM crops in particular'. The panel also commented on the way that wider pressures from outside the UK will have an impact, stating that:

'The key uncertainties around environmental impact are likely to be principally indirect. Economic factors (at micro and macro level) will drive decisions at farm and regional level and hence lead to potential indirect effects. Changes in EU agricultural regimes are likely to be far more significant causes of such indirect effects'.

Industry is not opposed to monitoring. Their representatives comment that they are used to the idea of post-release monitoring because of their past experience with pesticide products. For example, one representative commented that the pesticide model has worked well and that the model for GM crops could be similar. Industry point to the way crops are grown elsewhere in the world and how we are learning from their experiences.

In the consultation response to the new Directive, effects that people wished to have monitored included the impacts on wildlife and biodiversity; impacts of the GMO itself; impacts of crop management; economic impacts; cumulative effects; resistance e.g. weed, fungicide insect etc. Respondents also suggested that monitoring measures should be included for unanticipated effects and that monitoring should be carried out by an independent body, although others felt that this should not mean increased expenses are incurred (DEFRA 2001). The adequacy of monitoring long-term effects was also a cause for concern.

The NFU support the need for post-release monitoring and call for the introduction of a statutory regime. Post-release monitoring and future management practice requirements are a particular concern for farmers. Although they feel risks of the introduction of biotechnology are considered low, they have concerns about the integrity of the food chain and impacts on farming efficiency. Of concern is the transfer of herbicide resistance to weed species, that there may be a reduced efficacy of agrochemicals, and cross contamination between non-GM and GM crops. Of particular concern is that methods of zoning or isolation required to control the volunteers of new future 'designer' varieties of oil seed rape would be unpopular, difficult to implement and reduce the flexibility of land use. They note that herbicide tolerant volunteers in oil seed rape already cause a problem for farmers. There is also

concern that monitoring is only of use if there is reasonable certainty that any negative impacts picked up by the monitoring programme could be readily reversed. For example, a letter by Scottish Natural Heritage in response to consultation on implementation of Directive 2001/18/EC in October 2001 commented that monitoring should not be a substitute for risk assessment when there is potential for the impacts to be irreversible (e.g. gene flow to native populations).

### 3.1.3.1 Co-existence of GM and non-GM crops

With the possibility of commercialisation of GM crops in the UK, issues surrounding the co-existence of GM and non-GM crops have become central to discussions concerning GM crops. Co-existence refers to 'the economic consequences of adventitious presence of the material from one crop in another and the principle that farmers should be able to cultivate freely the agricultural crops they choose, be it GM crops, conventional or organic crops' (EC, 2003). It also relates to the issue of consumer choice and concerns over liability. The Government has stated it is committed to ensuring co-existence of different farming types (DEFRA 2002a) and has held discussions with interested parties about what measures might be necessary to allow for co-existence of GM and non-GM crops. In 2003 the AEBC, whose membership covers the broad spectrum of views on GM, issued a major report on co-existence and liability issues (AEBC, 2003).

Co-existence and liability issues have become a key concern in the UK. While those in favour of GM crops believe that management practices can be employed to prevent what they perceive as a small risk of contamination, organisations such as the Soil Association believe separation distances are inadequate and that contamination is inevitable. They point to research from the USA and Canada which indicates pollen can be transported over considerable distances (Soil Association, 2002). The most appropriate threshold levels for unavoidable or adventitious presence of GM material in non-GM crops or produce is the subject of much controversy (see Section 3.2.2). In 2002 around 4.1% of UK agricultural land was in organic production or conversion (AEBC, 2003). It is currently UK Government policy, particularly within the devolved administrations, to increase organic market share. The Soil Association are the leading certification body for UK organic production and have set their own *de facto* 'zero' threshold of 0.1%, i.e. far below the 0.9% required by EU law (AEBC, 2003). The Soil Association are critical of ACRE's management proposals that do not always require gene flow to be monitored, of their assumptions that there are no adverse effects as none have been reported, and that health effects are likely to be picked up at the research and development stage. They consider that post market monitoring should be the responsibility of DEFRA or approved agencies rather than companies (Soil Association, 2003). While the organic lobby consider that they are meeting the demands of their customers, such measures are perceived by industry as an obstacle deliberately placed in the way of commercialisation.

Both Government and industry representatives point out that there has been no loss of organic status throughout the FSEs (interview and DEFRA 2002a). SCIMAC and industry representatives further point out that gene flow in plants has been going on for centuries and is therefore nothing new (House of Commons 2002b). They are critical of environmental NGOs perceptions that any kind of gene flow is damaging and are keen to stress that co-existence is a management issue and not a problem of the genetic modification.

The AEBC have taken evidence from a wide variety of expert stakeholders on the co-existence of the first generation of GM crops that may be grown commercially (see also Section 3.2.2). They considered what would be practicable and what should occur if GM crops turned out to have a harmful effect on the environment. Their report focuses on the need to maintain consumer choice and listed nine recommendations:

The main aim of Government policy on co-existence of GM and other crops must be to facilitate consumer choice to the greatest possible extent, while allowing UK farmers to respond to present and future national and international market demand.

If GM crops were to be grown commercially, farmers growing them should be required to follow legally enforceable crop management protocols designed to achieve at least the 0.9% threshold.

If GM crops are commercialised, there should be an initial introductory period where there would be intensive monitoring and auditing of co-existence arrangements to determine whether and how far co-existence was actually being achieved.

The powers to impose co-existence protocols should allow for their ready amendment if data gathered in the introductory period showed that co-existence and the delivery of consumer choice was not being achieved and Government should be able, if necessary, to suspend production of a GM crops unless and until arrangements were made to overcome co-existence problems.

There should be special arrangements for compensation for farmers suffering financial loss as a result of their produce exceeding statutory thresholds through no fault of their own, with a view to an insurance market developing in due course.

Government should use the general approach of the draft Environmental Liability Directive to develop the UK's liability regime for any damage caused by the release of GMOs to the environment.

The Environmental Protection Act 1990 should be amended to allow the competent regulatory authority to require environmental remediation where reasonable and appropriate in respect of environmental harm caused by the release of GMOs, irrespective of criminal liability.

The Environmental Protection Act 1990 should be further amended, reflecting the regime envisaged by the draft Directive. The means of dealing with any environmental effects from the release of GMOs, including diffuse effects, should be the responsibility of the competent regulatory authority, which will have a number of options at their disposal, including requiring remediation.

Active consideration should be given to the development of protocols for positive environmental management of the cultivation of GM and other crops, to operate alongside co-existence protocols. (AEBC, 2003.)

Should commercialisation go ahead, the AEBC recommend that greater caution should occur in the initial years, with auditing and monitoring of GM crops. They note that: 'Precaution should therefore continue to be the basis of Government policy-making, based on all the evidence available.' Several members also felt that initially a statutory annually revisable limit should be placed on the amount of GM seed sold and grown. The AEBC recommend that responsibility for overseeing co-existence responsibilities should be entrusted to a representative group of stakeholders or a Government led-scheme.

Gene-flow and separation distances continue to be a contested issue among stakeholders, with different perspectives drawing on different research to back their perspectives. The AEBC (2003) reports that based on a literature survey by the National Pollen Research Unit, the Soil Association recommend separation distances for 1km for beet, 3km for maize and 6km for oilseed rape. Whereas the FSEs used distances of 200m for maize and oilseed rape, while for beet 600m was used. Both the AEBC report and the Science Review note that the main factor in successful co-existence is not necessarily adventitious presence from cross-pollination and thus separation distances. Farm management practices, co-operation between farming neighbours, political decisions about thresholds and market forces are all likely to have an impact. The National Farmers Union is confident that co-existence could work in principle with the appropriate protocols put in place, others, are more sceptical. They point to the lack of experience in the UK of growing such crops, the

lack of financial incentive for the farmers to minimise adventitious presence in other farmers' crops and the experiences of other countries. There is concern that farmers would not follow voluntary protocols as they should, and this view is upheld by a recent US survey which found that almost 20% of US farmers surveyed had not complied with a particular requirement to prevent build up of insect resistance (AEBC, 2003).

### **3.1.3.2 Regional differences**

Not all the areas of the country agree on their policy towards GM crops. As noted earlier, each of the devolved administrations have their own competent authority. This can therefore present difficulties for the national Government, as they need to their obtain agreement from the devolved administrations over matters concerning GM crops. Further, following the co-existence amendment to EC directive 2001/18/EC, each of the devolved administrations is now able to introduce their own co-existence arrangements. A number of counties within England, such as Devon and Dorset, are promoting themselves as GM free areas and the devolved administrations of Wales and Scotland are applying as restrictive approach as possible. The Scottish Government for example, has stated 'We will rigorously apply the precautionary principle in our approach to GM crops' (AEBC, 2003). For these areas a precautionary approach includes guarding against the effects of economic harm as a result of difficulties with co-existence of GM and non-GM crops.

The Welsh Assembly, in particular, is perceived as being instrumental in raising the profile of co-existence issues at EU level and putting the issue of co-existence between GM and non-GM crops firmly on the EU agenda. The National Assembly for Wales (NAW) is applying the most restrictive approach possible within the EU legislation, with the aim of keeping its products distinctive for marketing purposes. Although this is commercial position, environmental arguments are used for precaution. Agriculture in Wales consists of predominantly small farms and there is particularly concern over the potential for cross-pollination of neighbouring crops. This is related to the growing scale of organic production in Wales and farms involved in agri-environment schemes. To protect the integrity of non-GM crops, NAW served a notice on Aventis Crop Science UK (now Bayer) introducing legally enforceable separation distances for T25 Maize, using powers devolved to them under the Environmental Protection Act (NAW). The statutory separation distances made obligatory the SCIMAC voluntary guidelines. This triggered an Article 16 notification by the UK Government under the Deliberate Release Directive. The Government argued on behalf of the Welsh Assembly that the T25 maize would involve a 'risk to the environment' and that the Part C consent granted had not addressed the issue of safeguards for neighbouring GM crops. (UK Permanent Representation to the EU, letter 13.7.01). The Assembly further argued for a broad reading of 'protection of the environment'. They expressed concerns that the Organic Standards Regulations 1804/1999, which provides for minimum standards for organic production and requires an environment in which organically pure crops may be grown, was inconsistent with issuing part C consents for GM crops that may contaminate organic crops (Annex to Aventis prohibition notice.) The EC has questioned the legal basis of the UK Governments action. However, the prohibition notice remains in force as the Commission has not advised that it contravenes the directive.

### **3.1.3.3 Issues associated with co-existence of GM and non-GM crops**

Who should be liable when things go wrong is a particular concern and a key sticking point in negotiations over the commercialisation of GM crops. Farmers' organisations, and those sceptical of the introduction of GM crops, do not agree that farmers should be liable for any financial loss incurred. They argue that if the technology is not a problem, as the seed companies indicate, then there should be no difficulty with seed companies accepting liability. However, companies do not believe they should be liable, arguing that GM crops are safe and any problems would be due to the way they were managed. The Environmental Audit Committee (House of Commons, 2004) and AEBC have both highlighted liability as a key issue. Further, the regional authorities and devolved administrations of Scotland and Wales have applied pressure for the issue of liability to be resolved before going ahead with any planting.

A key problem noted in the AEBC report (2003) is that of compliance with any co-existence protocols where there is no market driver to ensure that a farmer growing GM crops will protect their neighbour. In its report on co-existence, the AEBC expressed the view that farmers should be compensated for losses and has estimated that for sugar beet loss of the organic premium would be £460/ha, for forage maize £500/ha, and for grain maize £150/ha (AEBC, 2003). No estimate was available for organic oilseed rape as very little is grown in the UK. In the Government's statement on the commercialisation of the GM crops trialled in the FSEs, the Secretary of State for the Environment noted that 'any compensation scheme would need to be funded by the GM sector, rather than by government or producers of non-GM crops.' (DEFRA, 2004a). Currently there is no insurance company willing to insure GM crops in the UK and, as noted by the AEBC, insurance companies do not tend to move very rapidly into new markets. Existing laws could be used, however, the AEBC notes that making co-existence arrangements statutory would have the advantage of providing greater clarity for the position of GM crops in law. Industry representatives have a preference for a voluntary code of practice. Previous experience with a poisonous crop, high erucic acid oilseed rape (HEAR), is cited as demonstrating that protocols can be made to work.

There are many unresolved aspects associated with maintaining an effective co-existence protocol. Such as what farm assurance and stewardship scheme would be best implemented, how to provide an appropriate land information system, who should pay for auditing and monitoring and who should compensate for economic loss. Work is now underway by government to resolve some of the issues. However, as the UK has not yet experienced growing GM crops on a commercial scale, the likely extent of the problems are unclear.

#### **3.1.3.4 Traceability and labelling**

The UK Government comments that they are 'working with the European Union to develop further regulations on the authorisation, traceability and labelling of GMOs. They state that they 'support labelling rules that are practical, proportionate and enforceable and in line with our international obligations' (DEFRA GM web site). However, the UK voted against the new EU labelling rules because of concern expressed by the Food Standards Agency (FSA). The FSA were concerned that for some products the labelling rules would be unenforceable and result in an increase of fraud, and that they could have a disproportionate impact on small business and there could be increased costs to the consumer. The UK therefore advocated retention of the existing labelling rules, but with additional rules on the use of 'GM free' labelling to take account of those consumers wishing to avoid GM food completely (FSA, 2002). The new Traceability and Labelling Regulation ((EC) 1830/2003) and GM Food and Feed Regulation, ((EC) 1829/2003) have since been agreed at European level. In March 2004 the FSA and DEFRA launched a joint consultation on their implementation.

#### **3.1.3.5 Potential agricultural intensification/sustainability**

A common theme expressed by those interviewed was the potential for GM crops to increase agricultural intensification. Scientists and environmental NGOs are concerned that GM crops could lead to the intensification of agriculture accelerating the loss of biodiversity and be in conflict with Biodiversity Action Plans. Intensification could result from the varieties used or from management practices, for example, winter sown crops can result in very little diversity of plant material. However, this is not just perceived as a GM issue, as one respondent commented:

'it depends on how we use GM crops and there is good evidence that conventional crops affect biodiversity'. (Scientist interview).

A nature conservation representative pointed out that 70% of farmland biodiversity in this country is outside fields (in woodlands and margins), increases in productivity could free up more land for biodiversity, but it is questionable whether biotechnology developments will actually lead to this (AEBC 2001a).

Conventional agricultural practices have been used as the baseline for the potential effects of GM crops. The House of Commons Select Committee on Environment Food and Rural Affairs have argued for comparative models of change, reasoning that conventional agriculture has evolved through time, therefore 'Analyses of GM technology must compare potential change from that source with predictable change as a result of conventional farming' (House of Commons 2002b). However, environmental NGOs point out that little is still known about the environmental impacts of conventional agriculture.

The need for considering GM crops in context rather than as an isolated technology, and to be set within a wider debate about the kind of agriculture society wants, is a related common theme. The Five Year Freeze for example, argues that GM agriculture should be included in any review of the future of farming in the UK. Wider landscape implications are an emerging concern (see Pretty, 2002). Thus unlike many other issues, the potential for agricultural intensification as a result of the use of GM crops, and the impacts on agricultural sustainability, are not such contested issues. The Science Review does, however, note that there is scientific disagreement about the amount of information required to demonstrate the long-term environmental sustainability of GM pest and disease resistant crops (GM Science Review Panel, 2003).

### **3.1.4 Conclusion**

A more open approach has led to the Government to concede that current research may be inadequate for decision making on commercialisation and that further research is therefore required. The implementation of a review of scientific uncertainties in 2003 demonstrates the way that the Government has recently broadened its view over uncertainty and is evidence of Government's recognition that it may not have all the information required. Thus there was a shift in the Government's position as it has gradually accepted that more research is required before a decision on commercialisation could be made.

The Science Review, while highlighting areas where there is need for further research did not raise any fundamental objections to the technology. Both the Science Review Panel and the economics study point out that while GM agriculture is not risk free, neither is non-GM. The Science Review further highlights the dynamic nature of the process commenting that:

'Regulatory evaluation needs to keep pace with the challenges posed by developments in this technology and recognise progress in understanding and knowledge'. (GM Science Review Panel, 2003).

However, national structures are not necessarily adequately addressing peoples concerns, particularly at the local level. This is particularly apparent in areas such as Wales and the South West, where agriculture is small scale and organic and environmental farming is being promoted. Consequently, not only are areas within the UK being restricted by a narrow national approach to regulation, but the promotion of an opening up of processes within national government and inclusion of wider expertise, and hence broader concerns, is being restricted by the requirements of EU directives.

For many policy actors risk assessment remains inadequate while it focuses on the science and does not include broader issues. They remain sceptical over the ability of the regulatory regime to control the technology. Despite Government and ACRE's assurances, those critical of GM are concerned about the uncertainties over the risks to health and the environment and the co-existence of GM and non-GM crops (see GM Science Review Panel, 2003). There is a lack of trust in the scientific judgements being made and 'expert' perceptions are viewed as not grounded in the real world. In this respect, the FSEs provided a focus for peoples broader concerns and brought them to the formal attention of government through the publication of the AEBC report 'Crops on Trial'. For non-scientists it is often the process that is important rather than a specific technology or the science itself (few people are sufficiently knowledgeable to be critical of the detail of the science). 'Experts' making decisions are criticised for

not taking communication seriously. For example, the National Consumer Council (2002) comments 'traditional risk communication typically sees the process as an add-on at the end of the risk management process', exemplified by Government's attitude of 'we make the decision and then we tell you what the decision is'. Clarity, openness and inclusion are considered important characteristics of a risk regulatory system and are consequently aspects which attract criticism and affect trust. Further, risk governance currently does not take account of the fact that the costs and benefits are not the same for everyone, yet the strength of precautionary measures demanded is related to peoples perceptions of utility.

Thus, while Industry view precaution as already operating at an early stage in the regulatory process, others consider that it is brought into the process too late and that precautionary measures should be more holistic. Improvements in a precautionary approach will require a broadening of research agendas to consider conventional agricultural impacts if the basis of decisions is to satisfy the needs of those seeking improvements in comparisons between GM and non-GM agriculture. The following section considers the role of expert judgements in taking a precautionary approach.

## **3.2 Expert judgements**

### **3.2.1 ACRE**

As noted in section 3.1.2, ACRE is the scientific body in the UK responsible for advising the Government on the risks to health and the environment of the release and marketing of GMOs. In 1999 the expertise within ACRE was broadened to include agroecological expertise and members with direct links with the biotechnology industry were removed. Today it contains a broad range of expertise from plant biotechnology to expertise in wildlife conservation, agronomy, sustainable agriculture and rural development. It considers that, as far as possible, it provides neutral advice (interview).

Despite attempts to broaden expertise, ACRE has been criticised, for example, by the Five Year Freeze (Five Year Freeze, 2001), for not having a public interest group representative or a lay person. As noted in section 3.1.2, stakeholders have been critical of the limited remit of ACRE. The former ACRE Chairman has himself expressed frustration with the way the regulatory system only allows ACRE to comment on the risks and not the benefits of commercialisation of GM crops. He also remarked on the impossible situation of ACRE who receive blame from both sides and feel they are in a no-win situation.

ACRE is committed to openness and minutes of ACRE meetings are made publicly available on its web site, as are reports and advice to the Government. It produces an annual report and clearly states the interests of its members. However, it does not generally have open meetings in the same way as the AEBC (see Section 4.2). There are close links between ACRE and the AEBC, with meetings between the two chairs to consider how the two committees might interact. There has been particular enthusiasm for pooling information where the two committees have overlapping interests, for example, on environmental harm and liability. (ACRE minutes 13/9/01). ACRE also has links with other advisory bodies such as the Advisory Committee on Novel Foods and Processes (ACNFP) and the Advisory Committee on Pesticides (ACP), who they work closely with on GM crops and pesticide matters (AEBC 2001b).

Although Acre's deliberations are not open to the public, opportunities do arise for critics to present their views such as open meetings and public hearings. Stakeholders have taken advantage of such opportunities particularly in the case for T25 maize (see Section 3.1.2.1) and the Farm Scale Evaluations (see Section 3.1.1.1) to voice their concerns.

### **3.2.2 The AEBC**

The Agriculture and Environment Biotechnology Commission (AEBC) is an experimental advisory body established in June 2000 in response to a lack of public

confidence in the UK on GM crop issues. The establishment of the AEBC is widely regarded as an acknowledgement of the need for a broader framework that allows for the inclusion of legitimate factors other than just the science. Although industry representatives point out that their role in evidence based approval system is unclear (House of Commons 2002a, Annex).

The AEBC has a broad remit, to consider current and future developments in biotechnology in relation to agriculture and the environment. Its terms of reference include providing the Government with independent strategic advice; liaison with other advisory bodies; advising the Government on the ethical and social implications and their public acceptability, and to consider and advise on specific issues relating to relevant aspects of biotechnology. As part of this process it is also expected to identify gaps in the regulatory and advisory framework, consider the wider implications of the lessons to be learned from individual cases regarding regulatory decisions, and to make recommendations on changes in the structure of regulatory and advisory bodies (AEBC 2001c).

The Committee consists of 20 members representing the broad range of views on biotechnology, from those who are very opposed to GMOs to those who are in favour. While some of its members have been involved in GM debates others have not. Their occupational expertise includes farmers, lawyers, academics, public sector research scientists, public interest groups, philosophers, industry consultant, a writer and broadcaster and a lay person. Their interests are clearly declared on the AEBC web site.

The AEBC is committed to openness and transparency. As noted in their co-existence report (2003), their approach to looking for solutions is to 'listening carefully'. They aim to pay particular attention to social and ethical dimensions as well as technical and legal ones. Its chairman reports that the AEBC co-ordinates its activities 'quite closely' with the Human Genetics Commission and the Food Standards Agency (M. Grant, Q. 145, House of Commons 2002a). It consults widely on its workplan and meetings are generally open to the public. All documents, including minutes of meetings, draft and final reports and transcripts of evidence are made available for public scrutiny on their web site. They also make particular effort to hold their meetings in different locations around the country. Their transparency has been commended by the House of Commons House of Commons Select Committee on Environment, Food and Rural Affairs, who congratulated them on the example they set (House of Commons 2002b).

The AEBCs work has involved studies on decision making on the Farm Scale Evaluations, animals and biotechnology, co-existence of GM and non-GM crops, horizon scanning and advising on the formal public debate. Future work topics include Global influences on the UK GM agenda, and public and privately funded research agendas on GMOs.

The work of the AEBC appears to be well respected by policy actors and influential in their thinking on the issues. Their reports, in particular, have acted as catalysts for further deliberations. However, some concern was expressed by industry representatives that the AEBC was no longer relevant. For example, one Industry representative commented that a committee set up in the heat of the moment would just perpetuate the differences between stakeholders and added 'our perception is that the debate has moved on'.

### **The AEBC in action: 'The Crops on Trial' report and the Co-existence and Liability report**

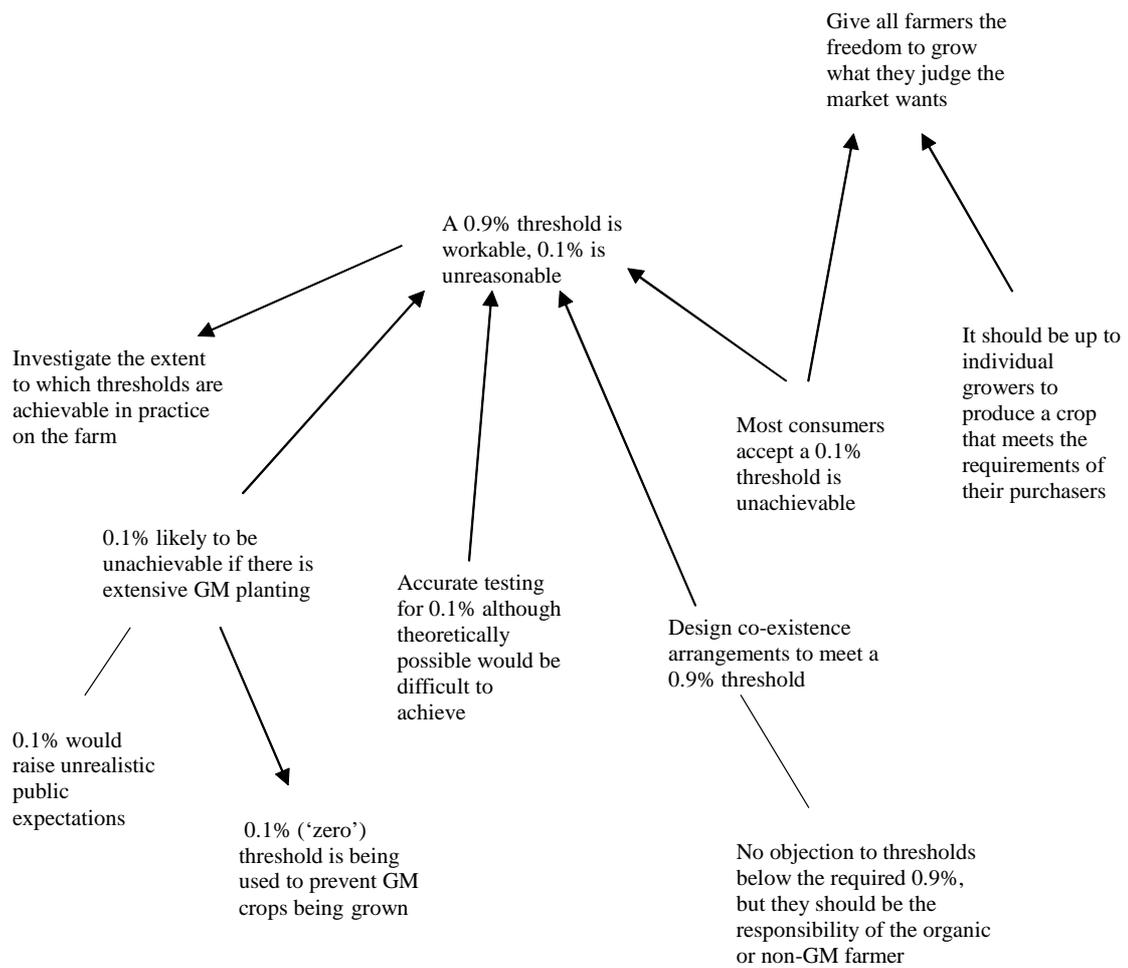
The AEBCs commitment to openness and the inclusion of a diversity of perspectives is demonstrated by their report on the conduct of the FSEs, 'Crops on Trial' (AEBC 2001b). This involved an extensive information gathering exercise with public meetings and verbal evidence gathered from scientific and academic experts, members of the public and NGOs. The information was collected in an open and transparent way, with full transcripts of meetings and expert evidence being made publicly available on their web site. People and groups who previously felt that their voice went unheard were listened to. The AEBC's methods also allowed for points of

concern to be clarified, for example, what answers the FSEs were designed to provide. All recommendations from the report were accepted by the Government (although the Welsh Government could not accept that the FSEs should continue), and two have been acted on – seeking the AEBC's advice on a 'public debate' on commercialisation of GM crops and setting up a baseline study of the environmental effects of different agricultural practices.

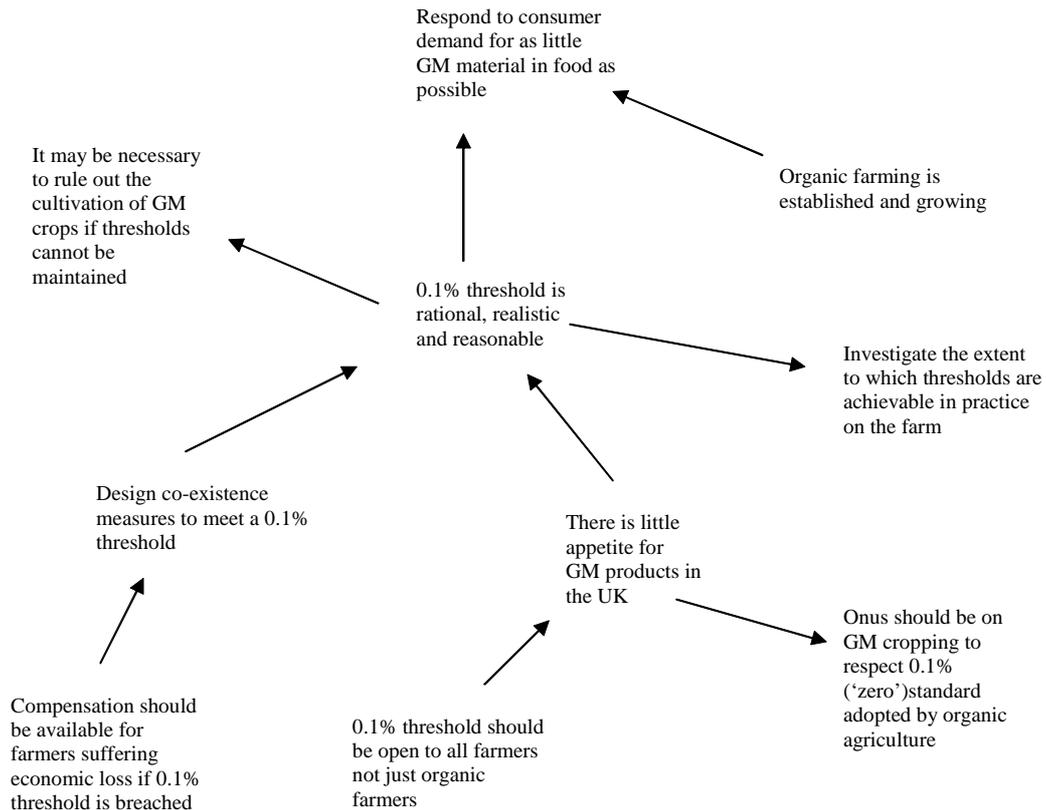
The production of the FSE report and the subsequent report on co-existence (AEBC, 2003), was not an easy process because of the divergent views of AEBC members. There were several points in the co-existence report where the AEBC was unable to agree. For example, on whether co-existence arrangements should be arranged to deliver a threshold of 0.1%. While some members felt that in order to respond to consumer wishes a threshold of 0.1% should be maintained, others felt that this was unworkable and that it was unreasonable to insist that growers meet a threshold below the 0.9% required by law. These differences led the AEBC to conclude that:

'an independent stakeholder body would face a near impossible task initially in getting broad agreement to the terms and protocols, particularly separation distances, if it was asked to accommodate a 0.1% as well as a 0.9% threshold'.

Figures 1 and 2 map the differences between the two views. They demonstrate the depth of view and indicate the limitations faced by multi-stakeholder bodies in reaching agreement.



**Figure 1 A map of the views of those arguing for a 0.9% adventitious presence threshold (the arrows link the above goal or aim to the thinking behind that aim or goal).**



**Figure 2 A map of the views of those arguing for a 0.1% adventitious presence threshold**

The lack of a consensus view on particular issues is inevitable considering the diversity of views of members of the AEBC. The lack of a consensus view reflects the way that GM is viewed by various stakeholders beyond government. Noting the differences provides insights into the different perspectives and indicates opportunities for ways forward. Working together has involved the AEBC in a mutual learning process whereby they have listened to alternative perspectives and considered others analytical approaches. This does not mean that they agree with one another or have changed their respective positions on GMOs. However despite their differences, influential reports have been produced with constructive recommendations for Government on how to address peoples concerns (e.g. AEBC 2001b and 2003). The reports form part of an on-going dialogue on GM crops and how to proceed.

The following section considers the key recommendation of the AEBC, that: 'Ministers must, through proper consultation engage with the public' if it is to take a decision on behalf of society' on GM crops (AEBC 2001b, p.15).

### 3.2.3 The national dialogue on GM Issues: GM Nation?

Following advice from the AEBC, the Government requested that the AEBC provide further advice on how to promote a wider public debate and how to make best use of the results (DEFRA 2002a). As noted by the minister at the time:

'The intention is to create a dialogue between all strands of opinion on GM issues'. (Government response to AEBC, April 2002).

There were different views about what a debate would achieve. For some stakeholders it represented an opportunity for a process of mutual learning. For the

Government it was seen as a way 'to identify the questions which the public has and provide information in response' (Meacher, Hansard, 15 July 2002) and for industry representatives as a means for educating and informing people. Nevertheless, it represented an intentionally more formal approach to broadening expertise by including the wider public in an 'overall programme of dialogue'.

The formal public debate consisted of three main components – 1) GM Nation? – a wide public debate overseen by an independent steering board; 2) a review of scientific issues of GM crops – run by the Government's scientific advisors; 3) a review of costs and benefits of GM crops – carried out by the Government's Strategy Unit.

In April 2002 the AEBC forwarded advice to the Government recommending that the debate be held by an independent organisation rather than the Government itself (AEBC letter to Government, 26/4/02). At the time The Select Committee on Environment, Food and Rural Affairs welcomed the AEBC's suggestions but with reservations. They felt unsure of the extent to which the wider public could be engaged and how conclusive it would be, commenting that:

'It is unfortunate that the crops chosen for use in the farm-scale evaluations are not directly used by consumers'. (House of Commons 2002b).

Their concern was that the public would be unlikely to perceive much advantage in the commercial exploitation of GM crops and that the debate would focus on the alleged risks without the balance of the benefits. They recommended to the Government that they address as a priority 'the question of the need to rebuild public confidence in science as an instrument of public policy, without which it will be extremely difficult to have a well informed public consultation and debate on matters such as the future of GM technology' (House of Commons 2002b).

On 31st May 2002, the Government announced the intention for a formal process of debate on GM crops. The purpose of the debate was not only to help make decisions about commercialisation of GM crops but also to assist Government negotiations within Europe, (DEFRA 2002b). A steering board was set up covering a broad range of expertise including seven members of the AEBC. Although initially only awarded funding of £250,000, following pressure from the debates steering committee, it was eventually doubled to £500,000. In order to allow the public concerns to frame the debate, a series of nine discussion workshops, with 18-20 participants in each, were conducted in different locations of the UK in November 2002. The issues generated were also used to guide the review of the science and economics study. To facilitate discussions, a web site, with links to the Science Review and economics study, was set up with background information on arguments for and against GMOs. Anyone interested was invited to contribute their view. It was the Steering Board's aim for it to 'be a unique and innovative exercise' and that rather than being an opinion poll, it should provide effective opportunities for people to deliberate on the issues (Steering Board, 2003).

In June 2003, 'GM Nation?' began to engage the wider public in a series of events. The organisers hoped to 'challenge people to think' (Steering Board, 2003). Stimulus material was produced and distributed to people participating in the debate, including a video a CD ROM and printed stimulus materials. Local organisations, Local authorities and individuals were urged to plan their own discussions and contribute. Debates and discussions on GM issues took place in towns and villages throughout the country. Over the course of the six week debate, 6 initial regional workshops were held, followed by an estimated 40 regional and county-level meetings and a further 629 local meetings (Steering Board, 2003). Over 1200 letters and e-mails expressing views were received and 36,557 feedback forms. To gain a 'Narrow-But-Deep' perspective, a further 10 discussion workshops were conducted with people who were not involved in GM issues.

The general findings of the debate were as follows:

People are generally uneasy about GMOs.

The more people engage in GM issues, the harder their attitudes and more intense their concerns.

There is little support for early commercialisation.

There is widespread mistrust of Government and multi-national companies.

There is a broad desire to know more and for further research to be done.

Developing countries have special interests.

Debate was welcomed and valued.

(Steering Board, 2003)

The Narrow-But-Deep perspective indicated that although the wider public are likely to share the main concerns of those people actively engaged in the GM debate (such as environmental NGOs) they may not have such a high degree of outright opposition.

In addition to the work of the Steering board, in April 2003 a citizens jury was organised by the Food Standards Agency (FSA, 2003). The Jury consisted of 15 people from Slough who addressed the question 'Should GM Foods be available to buy in the UK?' The jury voted nine to six in favour of GM foods being available to consumers in the UK. However, Genewatch, an NGO who took part in the jury, criticised the FSA for distorting its findings as the FSA failed to highlight that the jury also concluded that more time was needed to understand the long-term environmental implications before the crops were grown.

Citizens Juries were also held by a team of researchers from the University of Newcastle (PEALS, 2003). These were funded by Greenpeace, Unilever, the Consumers' Association and the Co-op. The juries were conducted in two different parts of England with people new to the subject of GM crops. Their conclusions, in brief, were that GM foods should not be on sale, that GM crops should not be commercialised owing to the lack of evidence of benefit and the application of the precautionary principle, and that long-term research was required.

### **Criticisms of the Public Debate**

The experimental nature of the formal public debate has meant it has attracted criticism. Academics have questioned assumptions underlying the debate, such as the capacity of science to resolve uncertainties and accommodate public concerns (Burgess et al., 2002). Consumer and environmental groups expressed concern that commercialisation will go ahead anyway and that the debate is 'just window dressing'. Criticisms have been made over the lack of time allowed, the amount of funding for the debate and lack of publicity. The background materials were criticised for being dull and uninspiring, and participants felt there was little guidance over how to facilitate meetings to ensure people were fully involved and their views accurately recorded.

There has been concern over the way the overall debate, including the Science Review and economics study, were structured. There was also concern, particularly from Industry, that it meant only the usual stakeholders and experts contributed and by others that it was elitist. As commented by one NGO:

'This was very much an elite debate for specialists and stakeholders'.  
(Mayer, 2003).

One key criticism was over the decision to appoint the Central Office of Information, previously a government department, to manage parts of the debate, particularly as it was recognised by the Government and the Steering Board that it was important for the debate to be seen to be held at arms length from the Government. Several witnesses to The Select Committee for the Environment, Food and Rural Affairs, who conducted an inquiry into the conduct of the debate, commented on the Central Office of Information's lack of expertise and necessary skills (House of Commons, 2003). A further criticism from Industry representatives was that the results were not

representative of public opinion. The industry alliance the abc, for example, commented that 'public meetings do not equal public opinion' (abc 2003b). Their chairman also commented that:

'Unfortunately, this exercise doesn't tell you anything new. When the public is asked in a statistically valid way, they can see why GM crops are so widely grown in other countries'. (abc 2003b)

In its final report the Select Committee upheld the view that the main element of the debate was not fully representative commenting:

'The debate also did not engage people beyond a self-selecting group which already held views about GM. Thus the wider public was in the main not informed by the debate, and nor were their opinions canvassed'. (House of Commons, 2003).

The difficulties of engaging with the views of the wider public have been the subject of discussion at subsequent events concerning the process of the public debate. It has also been a more general concern of the AEBC.

Critics, including the Select Committee, also commented on the way the outcomes of the economics study, Science Review and Farm Scale Evaluations were released too late in the process, so were unable to inform people's views. The Select Committee considered the blame to lie with the Government, rather than the debates Steering Board, for allocating insufficient funds and 'an absurdly tight deadline' (House of Commons, 2003). However, despite its criticisms and conclusions that 'overall the debate was an opportunity missed', the Select Committee were complimentary of the Narrow-But Deep exercise and the general aims of the debate. 'GM Nation?' represented a learning experience for all involved and many of the criticisms have been recognised by the Steering Board themselves. Their Chairman is keen to point out that:

'When people come to look back on the exercise they might share my view of rather a hesitant feeling that it has been a success'. (House of Commons October, 2003).

In March 2003, the Government and devolved administrations responded to the GM dialogue process stating that it has carefully considered the findings of the public debate, Science Review and costs and benefits study. It commented that:

'In deciding our policy on GM crops we have given due consideration to the findings of all three strands of the GM dialogue ...'. (DEFRA, 2004b)

While the Government accepted the economic study's conclusions that GM crops may be of limited economic value in the UK, they concluded that future developments have the potential to provide 'wide ranging benefits to farmers and consumers'. They acknowledge there are gaps in the knowledge base, but comment that this is true of any developing technology. For environmental NGOs, such comments were considered to ignore the public view presented in the public debate.

### **3.2.4 Conclusion**

Broadening expertise is an ongoing process. Through the establishment of the AEBC with a broad remit and widening ACRE's scientific expertise, the Government has responded to new concerns. The AEBC has particularly provided a means for focusing and highlighting current concerns over GM crops and has legitimised factors other than the science. Of particular concern for its members has been the involvement of all stakeholders' views and ways of engaging with public. The AEBC has enabled the inadequacies of regulation and government communication to be revealed, and a broader range of expertise to be voiced than has previously occurred. The broad spectrum of views represented by the AEBC has not necessarily resulted in a consensus on issues, but nevertheless has resulted in reports welcomed by most stakeholders. It has been influential on Government thinking and action, particularly through the publication of its reports. Further, its commitment to openness has set new standards.

The process of formal public debate has been recognised by many policy actors as an innovative endeavour (see for example, Stebbings, 2003). It represented an attempt to link expert judgements with broader public concerns for GM crops, and provided an opportunity for developing mutual learning. It represented a step forward in the conduct of public consultation for policy decision making processes. However, before the formal debate the Chairman of the AEBC commented that:

'I think the question at the core was to do with whether public debate can help to come through the polarisation (*of the debate*). We believe it can'.  
(M. Grant, Q129, House of Commons 2002a).

Yet 'GM Nation?' has done little to bring views closer together. Although other concerns, such as ethics and economics have been recognised by the Government, (see DEFRA 2004b), the decision on GM crops has remained one based on science, leaving many policy actors dissatisfied. Throughout the formal debate it remained unclear how 'public' views were to be fed into the overall decision about commercialisation. As indicated by the scenario workshop undertaken for this project, no decision by the Government on the commercialisation of GM crops would be without its difficulties. However, for those opposing the imminent commercialisation of GM crops, the Government's decision was seen to have ignored the public view and to be far from precautionary.

Thus the implementation of new structures, and broadening of existing ones, has yet to adequately address the socio-economic or ethical issues raised by stakeholders. Further, opening up government processes has yet to result in calming objections to the commercialisation of GM crops or criticisms surrounding scientific expertise. The following section reviews the views and roles played by the various stakeholders in the overall GMO debate.

### **3.3 Stakeholder roles**

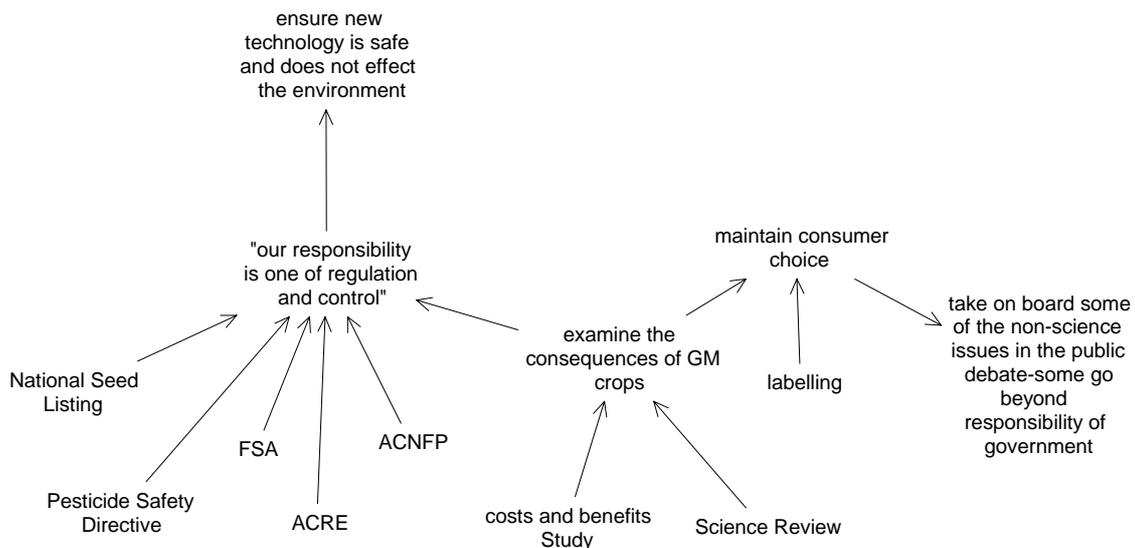
#### **3.3.1 Government**

As noted in the previous sections, Government is keen to rebuild public confidence in decision making. Taking a precautionary approach has therefore been central in their efforts to build trust. However, although the formal public debate exercise aimed to build trust, failure to adequately address people's views may lead to the opposite effect. The findings from the formal public debate demonstrate that greater openness and awareness is not alleviating public fears and that there is a desire for stronger levels of precaution. This was particularly apparent in the events held by the Science Review Panel. Several participants felt that their issues were not addressed as they were deemed to be 'non-scientific'. Such division between science and non-science was at odds with the way that many contributors to the debate viewed GM issues.

The pressure on the Government to demonstrate that it has taken on board the views from 'GM Nation?' is pointed out by the Chairman of the AEBC in his evidence to the select Committee:

'This has been, I think, a highly symbolic exercise in public trust and government. The public have put their faith in participating in the exercise on the basis of a pledge by ministers that they would be listened to'.  
(House of Commons, 2003).

The Government has attempted to respond to calls by stakeholders for greater participation in government decision making and more innovative consultation processes. However, the dominant view of the Government concerning GM crops is one of regulation and control (see figure 3) with an emphasis on science based regulation. Public opinion is viewed as a matter of consumer choice, (with the public viewed as consumers as opposed to citizens). Consequently, appropriate labelling remains the key mechanism by which public views may be accommodated within the regulatory process. Wider issues, such as the ethical aspects of GM crops, are viewed as beyond Government's immediate responsibilities.



**Figure 3 Map showing the Environment Minister's view of the Government's responsibilities**

**(Drawn from the minutes of evidence taken by the Environment, Food and Rural Affairs Committee for their report on the Conduct of the GM Debate (House of Commons, 2003); the arrows link the above goal or aim to how it is believed that aim or goal will be achieved.)**

### 3.3.2 Industry

As noted earlier, the industry representative's view remains firmly that a precautionary approach has already been applied at an early stage in the development of the GM products. They therefore question the need for wider public involvement and accuse those against GM crops of deliberately seeking to delay their introduction. While there is a general acceptance by policy actors of encouraging openness during the approvals process, industry representatives feel uncomfortable about greater public participation. English Nature has commented that 'people are beginning to realise that the debate is more complex than they thought' and that 'technology is part of public society so there has to be an on going debate, not just once and for all.' Yet industry representatives remain unconvinced. As one representative commented 'industry feels that given time the public will accept GMOs' (interview).

Industry representatives consider that industry's role is to foster and promote new innovations and hence new agricultural technologies. In response to current events, they have been forming alliances and have established a platform for the views of those with positive experiences of GM crops through the Agriculture and Biotechnology Council (abc). The abc was set up in the early part of 2002 and is concerned that there should be a fair debate over GM. It brings together BASF, Bayer Crop Science, Dow Agrosciences UK, Dupont, Monsanto UK and Syngenta. They state their aims as being:

To promote a reasoned and balanced debate about the use of agricultural biotechnology in the UK.

To work with all interested stakeholders to provide a source of information and learning on agricultural biotechnology.

To play an active role in the public debate, providing information, taking on board opinions and addressing any concerns.

To encourage and share more research to ensure a better understanding of the benefits that agricultural biotechnology can offer the UK.

The abc performs a distinct function from that of CropGen, another industry alliance who are industry's voice on the science.

The hostile climate generated in the UK towards the introduction of GM crops has impacted on the biotechnology sector more generally. Companies are closing or relocating their facilities elsewhere and some senior research scientists are being driven to work abroad. Companies are anxious for Government to convey a positive message for GM crops. Concern over these issues has led the Government to review its policy on the biosciences and to reinstate its commitment to the growth of the UK bioscience industry and development of new innovations (BGIT, 2003).

### **3.3.3 NGOs and farmers' organisations**

Environmental NGOs are also attempting to influence Government and public views by forming alliances to increase the weight of their arguments. They are producing critical reports and initiating dialogue among stakeholders. In 1999 the Genetic Engineering Alliance launched the Five Year Freeze campaign which sought to delay the introduction of GM crops. The campaign invites people to lobby Government on a minimum five year freeze on the growing of GM crops for any commercial purpose, imports of GE foods and farm crops and the patenting of genetic resources for food and farming. Since its inception the campaign has attracted the support of over 120 organisations, plus over 45 local authorities and 200 shops restaurants and local businesses and is heralded as an example of precaution in practice (Willis & Oldham, 2002). The Five Year Freeze have expressed concern that there are serious omissions in the regulatory system, a lack of essential safety research and that public consultation and information is minimal (Five Year Freeze, 2001). In total, nine policy areas are criticised. The extent of growth in concern in the UK is demonstrated by the number of organisations in the alliance, which represents over 4 million people. The wide range of interests includes local government, charities, religious groups, retailers such as the Body Shop, consumer bodies and environmental organisations, such as Greenpeace and Friends of the Earth. Their common concern is for greater precaution to allow time for the implications to be carefully considered.

Environmental NGOs and consumer groups have also raised concerns over the influence of industry. They have highlighted the way that industry is influential in what innovations are developed and questioned the lack of publicly funded GMO research. They have also been critical of the way companies are being allowed to carry out research into any novel innovation without any form of prior assessment by wider society.

Farmers organisations have highlighted the importance of the practical issues concerning farm management and GM crops, particularly concerning co-existence of GM and non-GM crops. For example, they have been initiating their own farmer surveys (e.g. FARM, 2003, NFU 2003b). The NFU, in particular, has expressed concern that the influence of commercial companies on farmers should not be underestimated and note the importance of explanatory information to ensure responsible use of the technology. Like the other stakeholders, farmers organisations have also been using their web sites to promote their views concerning current events on GM issues.

Organisations critical of the introduction of GM crops, such as the Soil Association, have been adding weight to their view of GM crops through their reports on the experience of Canadian farmers (Soil Association, 2002). They have also invited Canadian farming representatives to the UK to report to local growers on their

experiences. As noted earlier, the Soil Associations call for zero thresholds for the presence of GM material is perceived by some stakeholders as a deliberate act to erect barriers to growing of GM crops (AEBC, 2003). Prominence has been given to the arguments of the organic lobby by high profile people such as the Prince of Wales, who is himself a large land owner. Other large landowner organisations, such as the National Trust, have also been using their power to establish GM-free farming on their land.

### **3.3.4 Supermarkets**

UK supermarkets continue to be influential in supporting consumer reactions to GM products believing that their customers do not wish to purchase GM food. For example, following a customer survey showing that 78% remain unconvinced that GM food is safe to eat and 79% would not knowingly buy food containing GM ingredients, the Co-operative Group has stated that 'it will reject any Government proposals that allow the commercial planting of GM crops in the UK'. No longer will it allow GM crops to be grown on its land, the selling of GM food under its own brand or the investment of customer's money in GM technology (Co-operative News, 2003). Generally supermarket's own brand products are GM free, i.e. they contain less than 1% GM material. However, the AEBC was informed that they are either at or moving towards a 0.1% threshold (AEBC, 2003). Supermarkets do, however, sell products such as vegetarian cheese which uses GM material to assist processing.

### **3.3.5 Conclusion**

Committees, such as the FSA, ACRE and the AEBC, are engaging in an ongoing process of communication with each other and the wider community. There is increasing realisation of the need for communication and to work together to find mutually acceptable outcomes. The differences in perspective of the various stakeholders offer a means for highlighting different aspects of issues. They provide a richness of views and the different dialogues are forming part of the negotiation over what society as a whole would like to see. A wider range of expertise on official bodies is enabling a wider range of views to be heard. It is adding legitimacy to official reports and enabling more inclusive and hence less contested analysis of situations.

The importance of communication is recognised by all policy actors and they have been reviewing their communication processes. The openness demonstrated by the AEBC has prompted openness by other policy actors and the AEBC reports are provoking thought. Those outside Government are attempting to be influential in the debate in a variety of ways and although attempts may be far from perfect, the public is being given an opportunity to comment in a way that goes beyond what has been done before. Web sites, in particular, have become an important vehicle for the promotion of different perspectives. Through them industry, environmental NGOs, consumer groups and farmers organisations are publicly responding to Government consultations, presenting evidence to ACRE and AEBC, publishing reports and inviting public comments. Many of the various stakeholders have held, or contributed to, workshops and focus groups, and while not necessarily in agreement with each other, they are seeking an understanding of what lays behind others arguments.

By forming alliances policy actors are strengthening some perspectives and challenging others. By highlighting concerns and focussing on specific issues, they are providing a valuable function in raising issues not addressed by the regulatory system and highlighting areas for improvement. For example, it was the initial concerns of those concerned with the environment, particularly those of English Nature, which instigated the postponement of commercialisation of GM crops and the initiation of the Farm Scale Evaluations. Consumer organisations have been instrumental in highlighting issues concerning consumer choice and providing advice on managing risks that affect consumers (see for example, National Consumer Council, 2002 & 2003). The opposing views of Industry and the Soil Association have been particularly important for highlighting some of the practical issues and consequences for GM crop management and of meeting GM thresholds. Further, in

highlighting the potential problems with farming using GM crops, policy actors have also raised the profile of problems associated with conventional crops.

If the Government is to succeed in its aim to rebuild trust, the call by many people for a stronger precautionary approach cannot simply be ignored. A wider range of concerns than those currently dealt with by the current regulation process would need to be adequately addressed. Yet while Government has attempted to respond to calls for wider and improved consultation processes, there has been little advice as to how to deal with the wealth of perspectives, demands and expectations such processes generate. Further, its ability to respond to wider needs is constrained by the emphasis placed on science based regulation, both at local and European level, and the need to meet the requirements of EU directives.

## 4 Methods

Face to face interviews and telephone conversations were conducted with a range of representatives from Government, farmers groups, environmental non-government organisations, consumer organisations and industry (see Annex II). People were asked for their views on GM crops and the relevance of the precautionary principle and its use. In the initial phase of the PEG project contacts with policy actors were made through telephone conversations with a number of people. From these conversations information and advice was gathered about other people to contact and recent developments. Important documents were identified and advice was sought on further contacts. Information was gathered from documents released by all the relevant policy actors and from organisations' web sites, such as reports and position statements (see Annex IV). E-mail communications was used for clarification of points and for seeking further advice.

The web sites specifically set up for the UK formal public debate, science review and economics study were continuously monitored. The transcripts of the large body of evidence submitted to the following parliamentary committees during the duration of the research was also used: – House of Commons Environmental Audit Committee (House of Commons, 2004); the House of commons Select Committee on Environment Food and Rural Affairs (House of Commons, 2003 and House of Commons, 2002); and the House of Commons Select Committee on Environment Food and Rural Affairs (House of Commons 2002a). Information was also gathered from the media.

The research team was keen to involve policy actors at an early stage of the research and throughout the research process to ensure that the research outcomes were as relevant as possible to policy decisions. The scenario workshop was an important element of our research (see Oreszczyn, 2003). It was designed to capture some of the complexity of views on the situation in the UK and to consider potential dynamics and interactions that are not necessarily obvious from published documents. We aimed to use a scenario approach as a participatory element to engage with users of the research and ensure that our research questions and findings were embedded in the policy process itself. For controversial topics, such as GM crops, the workshop offered a way for different stakeholders to explore different policy scenarios in an open, imaginative and non-confrontational way, i.e. it provided a 'safe' environment in which people could air issues of concern. The activity was not, however, designed to look for agreement on scenarios or produce a consensus view on a particular scenario, as areas where there are disagreement can provide important insights. The outputs from the workshop generated data which was used to inform this report. Further, the practical experience and observations and those also carried out in the partner countries, were used to inform the design of a further European workshop in Brussels with European policy actors, and are being used to inform the overall findings of the PEG project.

## **Acknowledgements**

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## References

- abc (2003a) Agricultural Biotechnology Council Oral Evidence taken before the Environment, Food & Rural Affairs Committee, Wednesday 10<sup>th</sup> September 2003. [www.abcinformation.org](http://www.abcinformation.org)
- abc (2003b) GM Nation? – ‘public meetings do not equal public opinion’. 24<sup>th</sup> September 2003 [www.abcinformation.org](http://www.abcinformation.org)
- abc (2003c) abc statement on Farm Scale Evaluation results 16<sup>th</sup> October 2003 [www.abcinformation.org](http://www.abcinformation.org)
- abc (2004) ‘abc call on the Environmental Audit Committee to focus on the facts’. 5<sup>th</sup> March 2004 [www.abcinformation.org](http://www.abcinformation.org)
- ACRE (2001) Risk Assessment for Release and Marketing of GMOs in the European Union. Paper by the UK joint Regulatory Authority and Secretariat to ACRE. 20 February 2001. <http://www.defra.gov.uk/environment/gm/index.htm>
- ACRE (2002) ‘The criteria used by ACRE to gauge harm when giving advice on the risks of releasing genetically modified organisms to the environment’. DEFRA, London. <http://www.defra.gov.uk/environment/acre/molecddata/index.htm>
- ACRE (2003a) Review of the GM inspection and enforcement regime covering the Deliberate Release of Genetically Modified Plant under Part B of Directive 2001/18/EC April 2003. DEFRA London. <http://www.defra.gov.uk/environment/acre/postmarket/index.htm>
- ACRE (2003b) Guidance on Best Practice in the Design of Post Market Monitoring Plans in Submissions to the Advisory Committee on releases to the Environment. ACRE Guidance Note 16. DEFRA, London <http://www.defra.gov.uk/environment/acre/subgroups.htm>
- ACRE (2004) Advice on the implications of the farm-scale evaluations of genetically modified herbicide-tolerant crops. 13 January 2004. DEFRA, London. <http://www.defra.gov.uk/environment/acre/index.htm>
- AEBC (2001a) Horizon Scanning Sub Group: note on a meeting on 11<sup>th</sup> June 2001. <http://www.aebc.gov.uk/>
- AEBC (2001b) Crops on Trial. <http://www.aebc.gov.uk/>
- AEBC (2001c) Annual Report 2000-2001. <http://www.aebc.gov.uk/>
- AEBC (2002) Draft of a New AEBC Work Plan. <http://www.aebc.gov.uk/>
- AEBC (2003) GM Crops? Co-existence and Liability. A Report by the Agriculture and Environment Biotechnology Commission. London <http://www.aebc.gov.uk/>
- AEBC (2004) Workstream scoping document: Public/private research agendas. AEBC 04//03 13 February 2004 <http://www.aebc.gov.uk/>
- BIGT (2003) Bioscience 2015: Improving the National Health, Improving the National Wealth. A report to Government by the Bioscience Innovation and Growth Team. Department of Trade and Industry. <http://www.dti.gov.uk/bio-igt/big-report.html>
- BBC Radio 4 (2004) Today Programme. ‘Councillor plans to halt GM Maize’. 17/03/04 <http://news.bbc.co>
- Burgess, J., Anderson, T., Irwin, A., Joss, S., Petts, J., Stirling, A., Wakeford, T., & Wynne, B. (2002) Some observations and proposals on the 2002-2003 Public Dialogue on possible commercialization of GM crops in the UK. AEBC GM Public Debate Steering Group Submission Nov. 4<sup>th</sup> 2002.

- Burke, M. (2003) GM Crops: Effects on Farmland Wildlife. Summary of the scientific papers published in the Philosophical Transactions of the Royal Society 29 November 2003.
- Consumers' Association (2002) The Precautionary Principle and Food Policy. April 2002
- Co-operative News (2003) Co-op Group says 'No' to GM crops. 22<sup>nd</sup> October 2003. <http://www.thenews.coop/details.php?id=214>
- Countryside Agency (2002), The State of the Countryside: summary of key facts. <http://www.countryside.gov.uk>
- CropGen (2004) 'The lights flicker on.' 9<sup>th</sup> March 2004. <http://www.cropgen.org>
- DEFRA (2001) Consultation on the implementation of Directive 2001/18/EC on the deliberate release of genetically modified organisms into the environment: Overview of responses. <http://www.defra.gov.uk/environment/gm/index.htm>
- DEFRA (2002a) UK Government, Scottish Executive and Northern Ireland Department of the Environment response to AEBC Crops on Trial report. <http://www.aebc.gov.uk/>
- DEFRA (2002b) Beckett Announces a Public Debate on GM. DEFRA Press Release 31<sup>st</sup> May 2002.
- DEFRA (2002c) 2<sup>nd</sup> Consultation on the implementation of Directive 2001/18/EC on the deliberate release of genetically modified organisms into the environment: Draft Implementing regulations. <http://www.defra.gov.uk/environment/gm/index.htm>
- DEFRA (2004a) 'Margaret Beckett Outlines her Precautionary Approach to GM crops'. Press Release and Statement on GM Policy, 9<sup>th</sup> March 2004.
- DEFRA, (2004b) The GM Dialogue: Government response. DEFRA, Scottish Executive Environment and Rural affairs Department, Welsh Assembly Government, Department of the Environment Northern Ireland. 9<sup>th</sup> March 2004.
- DEFRA (2004c) The GM Public Debate: Lessons learned from the process. March 2004  
<http://www.aebc.gov.uk/>
- Department of Environment (1994) Biodiversity: the UK Action Plan. Cm 2428, HMSO, London <http://www.ukbap.org.uk/>
- Eastham, K. & Sweet, J. (2002) Genetically modified organisms (GMOs): The significance of gene flow through pollen transfer. European Environment Agency Experts' corner report No. 28.
- EC (2000) Commission of the European Communities, Communication from the Commission on the Precautionary Principle. Brussels, 02.02.2000. COM (2000) 1.
- EC (2003) Commission of the European Communities, Commission recommendation on guidelines for the development of national strategies and best practices to ensure the co-existence of genetically modified crops with conventional and organic farming. Brussels, 23<sup>rd</sup> July 2003, C(2003).
- ECPA (undated), ECPA's Position on the Interpretation and Application of the Precautionary Principle. ECPA, 6, Avenue, E. Van Nieuwenhuysse. 1160 Brussels, Belgium.
- FARM (2003) Letter to the GM Crops Team, Prime Ministers Strategy Unit 26<sup>th</sup> February 2003. <http://www.farm.org.uk>
- Firbank, L.G., Perry, J.N., Squire, G.R., Bohan, D.A., Brooks, D. R., Champion, G.T., Clark, S.J., Daniels, R.E., Dewar, A.M., Haughton, A.J., Hawes, C., Heard, M.S., Hill, O.M., May, M.J., Osborne, J.L., Rothery, P., Roy, D.B., Scott., R.J. & Woiwod,

- I.P. (2003) The implications of spring-sown genetically modified herbicide-tolerant crops for farmland biodiversity.  
<http://agrifor.ac.uk/browse/cabi/detail/6c169d01f0cd6ca71ad5ad2ece6554a9.html>
- Five Year Freeze (2001) GM Food the Governments Record: Why we still need a moratorium. <http://www.fiveyearfreeze.org/indexb.htm>
- FoE (2003) Science as a Smokescreen? A report on the farm scale evaluations of GM herbicide tolerant crops. Friends of the Earth. February 2003.  
<http://www.foe.co.uk/>
- FoE (2004) Government Ignores Public and Science –GM given thumbs up Press release March 9<sup>th</sup> 2004 <http://www.foe.co.uk/>
- FoEE (2002) Biotech Mailout. Volume 8, Issue 3, pp2-5. Friends of the Earth Europe.
- Food Ethics Council (2003) Engineering Nutrition: GM crops for global justice.  
[www.foodethicscouncil.org](http://www.foodethicscouncil.org)
- FSA (2002) GM Food and Food Regulatory Impact Assessment. 25 March 2002 Food Standards Agency, London. <http://www.foodstandards.gov.uk>
- FSA (2003) FSA Citizens' Jury: Shopuld GM Food be Available to buy in the UK? Final Report. April 2003  
<http://www.foodstandards.gov.uk/multimedia/pdfs/gmcityfinalrep.pdf>
- Giles, J. (2003) Biosafety trials darken outlook for transgenic crops in Europe. Nature, Vol. 425 23 October 2003, pp.751
- Department of Trade and Industry, HMSO, London.  
<http://www.gmsciencedebate.org.uk/report/default.htm#second>
- GM Science Review Panel (2003) First Report: An Open Review of the Science Relevant to GM Crops and Food Based on Interest and Concerns of the Public. July 2003. Department of Trade and Industry. HMSO, London.  
<http://www.gmsciencedebate.org.uk/report/pdf/gmsci-report1-full.pdf>
- GM Science Review Panel (2004) Second Report: An Open Review of the Science Relevant to GM Crops and Food Based on Interest and Concerns of the Public. January 2004.
- Ho, M. (2002) GM Maize Approved on Bad Science. SPLICE. March/April 2002 Vol 8, Issue 2, pp8-10
- House of Commons (2002a) Select Committee on Environment Food and Rural Affairs Minuets of Evidence: Genetically Modified Organisms  
<http://www.publications.parliament.uk>
- House of Commons (2002b) Fifth Report of the Environment, Food and Rural Affairs Committee: Genetically Modified Organisms. HC 1220, Paragraph 27. House of Commons Select Committee, DEFRA  
<http://www.publications.parliament.uk/pa/cm/cmenvfru.htm>
- House of Commons (2003) Select Committee on Environment Food and Rural Affairs: Conduct of the GM Public Debate. Eighteenth Report of Session 2002-03. Report with minutes of proceedings, oral and written evidence. 20 November 2003  
[http://www.parliament.uk/parliamentary\\_committees/environment\\_food\\_and\\_rural\\_affairs/environment\\_food\\_and\\_rural\\_affairs\\_reports\\_and\\_publications.cfm](http://www.parliament.uk/parliamentary_committees/environment_food_and_rural_affairs/environment_food_and_rural_affairs_reports_and_publications.cfm)
- House of Commons (2004) Environmental Audit Committee: GM Foods – Evaluating the Farm Scale Trials. Second Report of Session 2003-04 volume 1. HC 90-1
- ILGRA (2002) The Precautionary Principle: Policy and Application. June 2002  
<http://www.hse.gov.uk/dst/ilgra/pppa.htm>

- Johnson, B. (2001) Joint Nature conservation Committee: Revised JNCC Position Statement on Genetically Modified Organisms. June 2001. <http://www.jncc.gov.uk/>
- Johnson, B. (undated) Field Trials in the UK: the precautionary principle in action? Science, Technology and Innovation Program Viewpoints [www.cid.harvard.edu/cidbiotech/comments/comments96.htm](http://www.cid.harvard.edu/cidbiotech/comments/comments96.htm)
- Levidow, L. & Carr, S. (2000) UK: precautionary commercialisation? Journal of Risk Research 3 (3) 261-270
- Levitt, R. (2003) GM crops and foods. Evidence, policy and practice in the UK: a case study. ESRC UK Centre for Evidence Based Policy and Practice in the UK: Working Paper 20.
- Marris, C., Wynne, B., Simmons, P., & Weldon, S. (2001) Public Perceptions of Agricultural Biotechnology's in Europe final Report of the PABE research project funded by the Commission of European Communities Contract no. FAIR CT98-3844 (DG12-SSMI). Centre for the Study of Environmental Change, University of Lancaster, December 2001 <http://www.lancs.ac.uk/depts/ieppp/pabe/index.htm>
- Mayer, S. (2003) GM Nation? Engaging People in Real Debate? Gene Watch UK October 2003. <http://www.genewatch.org/Home.htm>
- Moses, V. (undated) Agricultural Biotechnology and the UK Public. CropGen 31 St. Petersburg Place, London W2 4LL
- Moses, V. & Brannan, M. (2001) One Hundred Percent Safe: GM foods in the UK. CropGen December 2002, <http://www.cropgen.org>
- NFU (1998) Report of the Biotechnology Working Group. National Farmers Union, London.
- NFU (2003a) Farmer Attitude to GM Co-existence. Study prepared by the National Farmers Union, London. June 2003.
- NFU (2003b) NFU responds to GM Crops Trial Results. 16 October 2003. [http://www.nfu.org.uk/intradoc-cgi/idc.cgi\\_isapi.dll?IdcService=GET\\_DOC\\_PAGE&Action=GetTemplatePage&Page=NFU\\_HOME\\_PAGE](http://www.nfu.org.uk/intradoc-cgi/idc.cgi_isapi.dll?IdcService=GET_DOC_PAGE&Action=GetTemplatePage&Page=NFU_HOME_PAGE)
- National Consumer Council (2002) Risk and Regulation: themes paper for a seminar on 25 June 2002, National Consumer Council, 20 Grosvenor Gardens, London.
- National Consumer Council (2003) Winning the Risk Game: a three-point action plan for managing risks that affect consumers. National Consumer Council, London.
- Oreszczyn, S. (2003) PEG Workshop Report: GM Futures? Scenarios for GM Crops in the UK. The Open University, Milton Keynes. (<http://technology.open.ac.uk/cts/peg/index.htm>).
- Orson, J. (2002) Gene Stacking in herbicide tolerant oilseed rape: lessons from the North American Experience. English Nature, January 2002 <http://www.english-nature.org.uk/>
- PEALS (2003) The People's Report on GM. Policy Ethics and Life Sciences Research Institute (PEALS). University of Newcastle, Newcastle-upon-Tyne. <http://www.gmjury.org>
- Pretty, J. (2002) The Potential Effects of Genetically Modified (GM Crops on the Countryside and Rural Economy. Report for the Countryside Agency January 2002.
- Prime Ministers Speeches (2002) PM Speech: Science Matters, 10<sup>th</sup> April 2002. 10 Downing Street, London. <http://www.number-10.gov.uk/output/Page1715.asp>

- Scottish Natural Heritage (2001). Letter in response to consultation on implementation of Directive 2001/18/EC to GM Co-ordination team at SE October 2001.
- Soil Association (2002) Seeds of Doubt: North American farmers' experiences of GM crops. Soil Association, Bristol.
- Soil Association (2003) Guidance on Post-Market Monitoring of GM Crops – Soil Association Response to ACRE consultation, August 2003.  
<http://www.soilassociation.org/web/sa/saweb.nsf?Open>
- Solesbury, W. (2003) Research dialogue should replace dissemination. Research Fortnight 28 May 2003.
- Stebbing, C. (2003) Public Debate? Elements 19, pp. 9-11, October 2003. The Environment Council.
- Steering Board (2003) Report of the Steering Board: GM Nation? The Findings of the public debate. September 2003. Department of Trade and Industry. HMSO, London [http://www.gmpublicdebate.org.uk/ut\\_09/ut\\_9\\_6.htm#download](http://www.gmpublicdebate.org.uk/ut_09/ut_9_6.htm#download)
- Strategy Unit (2003) Field Work: Weighing up the Costs and Benefits of GM crops. Prime Ministers Strategy Unit, The Cabinet Office, London.  
[http://www.number-10.gov.uk/su/gm/downloads/gm\\_crop\\_report.pdf](http://www.number-10.gov.uk/su/gm/downloads/gm_crop_report.pdf)
- The Royal Society (2003) The Farm Scale Evaluations of spring-sown genetically modified crops. Papers of a Theme Issue. The Philosophical Transactions of the Royal Society. Series B, Volume 358, Number 1439.
- Willis, R. & Oldham, J. (2002) Precaution in Practice: how the precautionary principle is used by government, business and NGOs. Green Alliance May 2002.

## Annexes

### Annex I: Recent events concerning GM crops in the UK

Date	Event
1999	'Moratorium' agreed with industry while FSEs are conducted.
1999	Farm Scale Evaluations implemented
2000	EU Communication on the precautionary principle published.
2000	Campaign against placing T25 maize on the National Seed list instigated by NGOs
2001	AEBC publish report on the FSEs – <i>Crops on Trial</i>
July 2002	Government announces the three strands of the formal public debate process
September 2003	Report published on 'GM Nation?' the formal public debate
October 2003	Amended EU Directive transposed into English law
October 2003	Results of the Farm Scale Evaluations published
November 2003	AEBC report on the co-existence of GM and non-GM crops published
January 2004	Final report of the Science Review published
March 2004	Government announces its decision for the FSE crops and the commercialisation of GMHT maize and response to the formal public debate.
March 2004	Government report on the lessons learned from the GM debate process
March 2004	DEFRA and FSA launch consultation on the EU Traceability and Labelling Regulations and GM Food and Feed Regulations
March 2004	ACRE publishes its guidance on best practice in the design of post-market monitoring plans
March 2004	Bayer CropScience announces it will not continue with its efforts to commercialise GM forage maize in the UK

## **Annex II: Organisations from which representatives were interviewed**

Advisory Committee on Releases to the Environment  
British Society of Plant Breeders  
Agriculture and Environment Biotechnology Commission  
Countryside Agency  
CropGen  
Crop Protection Association  
DEFRA Biotechnology Unit  
English Nature/Joint Nature Conservation Committee  
Genewatch  
Genetic Modification and Biosafety Research Group  
Green Alliance  
Greenpeace  
National Consumer Council  
National Farmers' Union  
Novel Foods Committee  
SCIMAC  
Small Farms Association  
Soil Association  
Consumers' Association  
Welsh Assembly

### Annex III: DEFRA research projects

Current research projects	
Farm-scale Evaluations of GM Winter-sown Crops (Winter Oil Seed Rape) (EPG 1/5/125).	Summer 2004
Strategies for Risk Assessment, Minimising the Environmental Impact of Fungal Disease Suppressing GM Bacteria and Plants on Non-target Species (EPG 1/5/218)	Spring 2005
GMOs for Bioremediation of Organic and Inorganic Pollutants (EPG 1/5/142)	April 2004
Factors Affecting Rates of Cross-pollination in Maize Growing under Typical UK Conditions (EPG 1/5/210)	Spring 2008
Non-target Effects of Transgenic Crop Plants Resistant to Virus Diseases (EPG 1/5/215)	April 2004
The Insertion of Cauliflower Mosaic Virus into Host Genomes during Natural Viral Infections (CPEC9)	Early 2006
The Effects of Compositional Traits on the Survivability and Persistence of GM Crops (EPG 1/5/197)	April 2004
Environmental Impact of Bt Exudates from Roots of Genetically Modified Plants (EPG 1/5/156)	April 2004
Assessment of the Distribution of GM Material in Kernel Lots (EPG 1/5/207)	Early 2005
Mechanisms for Investigating Changes in Soil Ecology due to GMO Releases (EPG 1/5/214)	Spring 2004
Monitoring Movement of Herbicide- resistant Genes from Farm-scale Evaluation Field Sites to Populations of Wild Crop Relatives (EPG 1/5/151)	Summer 2004
Determining Risks to Soil Organisms Associated with a Genetically Modified Crop Expressing a Biopesticide in its Roots (EPG 1/5/217)	Summer 2004
Factors Affecting Cross-pollination in Oilseed Rape Varieties, Particularly of Low Fertility, Growing under Typical UK Conditions (EPG 1/5/216)	Autumn 2006
A Review of Research into the Effects on Farmland Biodiversity of the Management Associated with Genetically Modified Cropping Systems (EPG 1/5/198)	Summer 2004
Modelling the Effects on Farmland Food Webs of Herbicide and Insecticide Management in the Agricultural Ecosystem – Contract 2 . (EPG 1/5/194)	Summer 2004
A Generic Mathematical Model for the Integrated Management of a Crop Containing Anti-feedant Genes (RG0115)	Summer 2004
The Impact of Transgenes for Herbivore and Virus Resistance on the Weediness of crop relatives (EPG 1/5/132)	April 2004
Completed research projects	Final report published
Farm-scale Evaluations of GM Spring-sown Crops (Spring Oil Seed Rape, Fodder Maize, Beet) (EPG 1/5/127, 126 and 145)	October 2003
The Potential Value of the Field Scale Evaluations in Assessing the Impact of GMHT Crops on Birds and Mammals (EPG 1/5/137)	November 2003

Gene Flow Monitoring from the GM Crop FSE Sites: Monitoring Gene Flow from the GM Crop to Non-GM Equivalent Crops in the Vicinity. Part 1: Forage Maize (EPG 1/5/138)	October 2003
Quantifying Landscape-scale Gene Flow in Oilseed Rape (RG0216)	October 2003
Consequences for Agriculture of the Introduction of GM Crops (RG0114)	October 2003
Modelling the Effects on Farmland Food Webs of Herbicide and Insecticide Management in the Agricultural Ecosystem (EPG 1/5/188)	October 2003
A Review of Research into the Environmental and Socio-Economic Impacts of Contemporary and Alternative Arable Cropping Systems	May 2003
Monitoring Large Scale Releases of Genetically Modified Crops (EPG 1/5/84). Incorporating report on project EPG 1/5/30: Monitoring Releases of Genetically Modified Crop Plants	December 2002
The Risks and Consequences of Gene Transfer from Genetically-Manipulated micro-organisms in the Environment	October 2001
Waste Stream Monitoring of Genetically Modified Micro-organisms	October 2001
<a href="http://www.defra.gov.uk/environment/gm/research/reports.htm#Current">http://www.defra.gov.uk/environment/gm/research/reports.htm#Current</a>	March 2004

## **Annex IV: Web sites**

Agricultural and Biotechnology Council

<http://abcinformation.org/index.php>

Agriculture and Environment Biotechnology Commission (AEBC)

<http://www.aebc.gov.uk/>

Advisory Committee on Releases to the Environment (ACRE)

<http://www.defra.gov.uk/environment/acre/index.htm>

<http://www.defra.gov.uk/environment/gm/debate/index.htm>

English Nature

<http://www.english-nature.org.uk/>

The Five Year Freeze Campaign

[www.fiveyearfreeze.org](http://www.fiveyearfreeze.org)

The Food Standards Agency

<http://www.foodstandards.gov.uk/>

Friends of the Earth

<http://www.foe.co.uk/>

GM Nation – the UK Public Debate web site

<http://www.gmpublicdebate.org/>

Genewatch

<http://www.genewatch.org/Home.htm>

Greenpeace

<http://www.greenpeace.org.uk>

Joint Nature Conservation Committee

<http://www.jncc.gov.uk/>

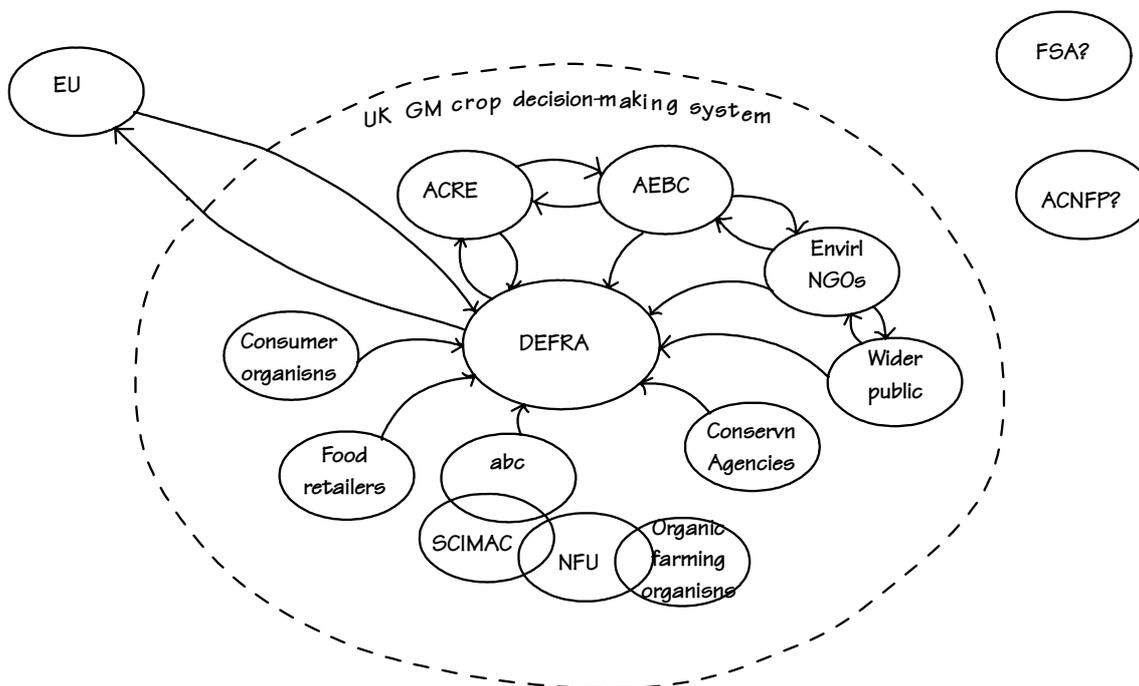
National farmers Union

<http://www.nfu.co.uk/>

Soil Association

<http://www.soilassociation.org/web/sa/saweb.nsf?Open>

## Annex V: Institutional links in policy learning



Institutional abbreviations:

ACRE: Advisory Committee on Releases to the Environment

ACNFP: Advisory Committee on Novel Foods and Processes

AEBC: Agriculture and Environment Biotechnology Commission

EC: European Commission

FSA: Food Standards Agency

NFU: National Farmers' Union

SCIMAC: Supply Chain Initiative for Modified Agricultural Crops

SNCAs: statutory nature conservation agencies, e.g. English Nature